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# INDEX TO VOLUME II, PART ONE (FOURTH SERIES)

**New Names in Blackface Type**


A

Abingdon Island Lizard, 143-147
Tortoise, 296-299
**abingdonensis, Tropidurus, 136, 138**
**abingdoni, Testudo, 259, 290, 293, 296-299**
**abingdonii, Testudo, 244, 296, 306**
Tropidurus, 136, 143
"Academy," 2, 98, 242
**acuta, Dafila, 80**
Adams, C. F., 228
**adelphus, Bulimulus (Næsiotus), 379**
Ægialeus semipalmatus, 53
Æpyornithes, 207
**æthereus, Phaethon, 104-107**
Agassiz, A., 228
Louis, 135, 226
**akamatus, Bulimulus (Næsiotus), 378**
**alba, Gygis, 32-34**
"Albatross," 136, 147, 155, 159, 172, 228, 245
Albatross, Galapagos, 91
albemarlensis barringtonensis, Tropidurus, 133, 139, 143, 168-172
Bulimulus (Næsiotus), **377-378**
Tropidurus, 133, 136, 137, 139, 143, 168, 172-188
**alethorhytidus, Bulimulus (Næsiotus), 379-380**
Amblyoma pilosum, 235
Amblyrhynchus ater, 192
(Amblyrhynchus) ater, Hypsilophus, 192
Iguana, 192
Amblyrhynchus cristatus, 133, 192-194
ater, 192
(Amblyrhynchus) cristatus, Hypsilophus, 192
Iguana, 192
Amblyrhynchus cristatus nanus, 192
demarlii, 188
subcristatus, 188
American Flamingo, 66-76
Americana, Mareca, 80
"Anas maculirostris," 79
Anous stolidus, 24-29, 41, 113
Anseriformes, 5
antillarum, Sterna, 41
antipodum, Megadyptes, 18
aquila, Fregata, 100-104, 130 (pl. 6), 132 (pl. 7)
Ardea herodias, 58-59, 114
arenaria, Calidris, 56
Arenaria interpres, 46-47
Atahualpa, 209
ater, Amblyrhynchus, 192
cristatus, 192
Hypsilophus (Amblyrhynchus), 192
Iguana (Amblyrhynchus), 192
Audubon, 109 (footnote)

B

Bahama Pintail, 44, 69, 70, 76-78, 79, 80
bahamensis, Pœcilonetta, 76-78
Baird's Sandpiper, 57
bairdi, Heteropygia, 57
Baldpate, 80
Bangs, 59 (footnote)
Barrington Island Land Iguana, 190-192
Lizard, 168-172
Tortoise, 365-366
barringtonensis, Tropidurus, 137, 138, 168
albemarlensis, 133, 139, 143, 168-172
grayi, 137, 168
Baur, 135, 136, 137, 138, 159, 164, 168, 172, 210, 228, 245, 246, 247, 249, 251, 252, 254, 255, 256, 257, 258
"Beagle," 135, 164, 220, 221, 222
becki, Testudo, 237, 244, 259, 292, 293, 298, 301, 303-305, 317
bedsi, Testudo, 303
Bell, Thomas, 135
Bibliography (Gigantic Land Tortoises), 369-372
Bibron, 223
and Dumeril, 249
Bindloe Island Lizard, 150-154, 159
Birds of the Galapagos Islands, with observations on the birds of Cocos and Clipperton islands (Columbiformes to Pelecaniformes), by Edward Winslow Gifford, 1-132
bivittata, Craniopeltis, 135, 136, 155
bivittatus, Tropidurus, 133, 137, 138, 139, 142, 155-159
Black-bellied Plover, 53, 56
Black-necked Stilt, 44, 54, 70, 76
Black Oyster-catcher, 53
Black Rail, 14
Blue-faced Booby, 20, 84-85, 87, 98

Blue-footed Booby, 44, 88, 89, 90, 91, 92, 93-97, 109
Blue-winged Teal, 76, 79-80
Booby, Blue-faced, 20, 84-85, 87, 98
Blue-footed, 44, 88, 89, 90, 91, 92, 93-97, 109
Brewster's, 20, 32, 85, 87, 97-100
Neboux's, 93
Peruvian, 36, 87, 89-93, 95, 97, 101
Red-footed, 85-89, 93
"Boston Eagle," 244, 316
Boulenger, 136, 254
Brewster, 47
Brewster's Booby, 20, 32, 85, 87, 97-100
brewsteri, Sula, 97-100, 117
Brilliant Teal, 79
Brown, Arthur E., 247
Brown Pelican, 25, 44, 107-110
Bruce, 207
Bulimulus cymatias, 381
(Næsiotus) **adelphus, 379**
**akamatus, 378**
**albemarlensis, 377-378**
**alethorhytidus, 379-380**
**cucullinus, 377**
**cymatias, 380,** 381
**elæodes, 376**
**hemærodes, 376**
**jervisensis, 381**
**lycodus, 379**
**ochsneri, 380-381**
**perrus, 376-377**
**rabidensis, 381-382**
sculpturatus, 381
tortuganus, 377
Buller, 18
Bursera, 102
Butorides sundevalli, 62-65, 116, 122 (pl. 2)
virescens, 65-66
Bynoe, 222, 225

## C

Calidris arenaria, 56
californiana, Testudo, 244, 245, 316
Camarhynchus, 229
Canvasback, 80
Cereus, 301, 326
Certhidia, 229
"Challenger," 228
Chamæpelia passerina, 9
Chapman, 66 (foot), 68 (foot), 71, 76
Charles Island Lizard, 164-168
Tortoise, 316-318
Chatham Island Lizard, 154, 155-159
Tortoise, 323-328, 338
chathamensis, Testudo, 244, 259, 290, 294, 323-328
chlororhynchus, Puffinus, 98
Clipperton, 211
Noddy, 20, 29-32, 98, 103
clypeata, Spatula, 80
Cochrane, 226
Colnett, Capt. James, 212
(Conolophus) demarlii, Hypsilophus, 188
Conolophus pallidus, 133, 188, 190-192
subcristatus, 133, 188-190, 191
subcristatus pictus, 188
Cooke, 210
Cookson, 136, 226, 228, 253, 254, 296
Cope, 136, 155
Cormorant, Flightless, 44, 80-84
Cowley, 210
Cowley Mountain Tortoise, 362-365
Craniopeltis bivittata, 135, 136, 155
Grayii, 135, 164, 172
(Craniopeltis) Grayii, Tropidurus, 136, 155, 164, 172
pacificus, Tropidurus, 135, 143
Creagrus furcatus, 35-42
Creciscus jamaicensis, 14
sharpei, 12, 13
spilonotus, 5, 12-16, 112
crepidatus, Stercorarius, 46
cristatus, Amblyrhynchus, 133, 192-194
ater, Amblyrhynchus, 192
Hypsilophus (Amblyrhynchus), 192
Iguana (Amblyrhynchus), 192
nanus, Amblyrhynchus, 192
Oreocephalus, 192
Crymophilus fulicarius, 57
**cucullinus,** Bulimulus (Næsiotus), **377**
Curlew, Hudsonian, 51, 54-55, 56
cyanops, Sula, 84-85, 92, 93, 117
**cymatias,** Bulimulus (Næsiotus), **380,** 381
Cyperus, 222

## D

Dafila acuta, 80
Dall, William Healey, Preliminary descriptions of new species of Pulmonata of the Galapagos Islands, 375-382
Dampier, 210
Dark-rumped Petrel, 36, 98
Darwin, 135, 164, 220
darwini, Testudo, 244, 259, 290, 293, 294, 319-323, 348, 353
Davis, Edward, 210
De Beauchesne, 211
De Berlanga, Fray Tomas, 209
De Freycinet, 244, 316
Delano, Amasa, 135, 212
delanonis, Tropidurus, 133, 136, 137, 139, 142, 159-164
demarlii, Amblyrhynchus, 188
Hypsilophus (Conolophus), 188

diamesus, Micranous, 29-32, 113
Diemictylus, 194
discors, Querquedula, 79-80
Dove, Galapagos, 6-11
Mourning, 9
Passerine, 9
Downes, Commodore John, 220, 255, 316
Drowne, F. P., 228, 229
Dumeril, 135
Dumeril and Bibron, 249
Duncan Island Lizard, 147-150
Tortoise, 306-312
duncanensis, Tropidurus, 133, 136, 137, 138, 139, 143, 147-150
Dusky Shearwater, 44, 91, 93, 110
Dwight, 5, 41, 45

E

Egret, 44, 58, 59, 76
egretta, Herodias, 59, 115
elæodes, Bulimulus (Næsiotus), 376
elephantina, Testudo, 354
elephantopus, Testudo, 244, 245-249, 255, 256, 259, 292, 316-318, 335 (as synonym), 354 (as synonym)
ephippium, Testudo, 234, 244, 251-252, 259, 291, 293, 298, 306-312
Ereunetes pusillus, 56
"Eugenie," 79, 135, 226
Evans, Whitton, 245

F

Fisher, 100
Fitzroy, 228
Flamingo, 54, 58
American, 66-76
Flightless Cormorant, 44, 80-84
Florida Gallinule, 16
forsteri, Sterna, 41
Franklin's Gull, 42
franklini, Larus, 42
Frazar's Oyster-catcher, 47-53, 58
frazari, Hæmatopus, 47
Fregata aquila, 100-104, 130 (pl. 6), 132 (pl. 7)
fulicarius, Crymophilus, 57
fuliginosa, Sterna, 19-24, 41
fuliginosus, Larus, 42-46
Fuligula vallisneria, 80
furcatus, Creagrus, 35-42
fuscus, Pelecanus, 107-110, 118

G

Gadow, 257
gadowi, Testudo, 257
Gaimard, and Quoy, 244, 245
galapagana, Williamia, 382
galapagensis, Hæmatopus, 47-53, 114
Galapagoan lizards of the genus Tropidurus; with notes on the Iguanas of the genera Conolophus and Amblyrhynchus, by John Van Denburgh and Joseph R. Slevin, 133-202.
galapagoensis, Nesopelia, 5, 6-11, 111
Porzana, 12
Testudo, 244, 249, 255-256, 257, 292, 316
Galapagos Albatross, 91
Dove, 6-11
Hawk, 36, 52, 91, 108
Heron, 44, 59, 60, 62-65, 76
Lizard, 172-188
Penguin, 16-19, 81
Rail, 9, 12-16
galeata, Gallinula, 5, 16
Galliformes, 5
Gallinula galeata, 5, 16
Gallinule, Florida, 16
Geospiza, 229
Gifford, Edward Winslow, Birds of the Galapagos Islands, with observations on the birds of Cocos and Clipperton islands (Columbiformes to Pelecaniformes), 1-132
Gigantic land tortoises of the Galapagos Archipelago, by John Van Denburgh, 203-374
glaucescens, Larus, 43
Glaucous-winged Gulls, 43
Graceful Petrel, 44, 93, 100
Gray, 223
grayi barringtonensis, Tropidurus, 137, 168
grayi, Tropidurus, 137, 164, 172
Holotropis, 172
Liocephalus, 172
magnus, Tropidurus, 137, 138, 172
Tropidurus, 136, 147, 155-159, 172
grayi, 137, 164, 172
grayii, Craniopeltis, 135, 164, 172
Holotropis, 135, 164
Leiocephalus, 135, 136, 155, 164
Liocephalus, 136
Tropidurus, 133, 136, 137, 139, 142, 164-168
(Craniopeltis), 136, 155, 164
Great Blue Heron, 58-59, 69
Green, G. M., 76
Green Heron, 65-66
Grinnell, Joseph, 61
Gull, Franklin's, 42
Glaucous-winged, 43
Sooty, 42-46, 76, 93
Swallow-tailed, 35-42, 106
Günther, 136, 206, 210, 227, 245, 246, 248, 249, 250, 251, 252, 253, 254, 256, 290, 292, 317, 329

**güntheri, Testudo, 244, 246, 253, 256-257, 259, 260, 289, 291, 295, 325, 332, 335-343, 344, 348**
Gygis alba, 32-34

H

Habel, 135, 143, 151, 226
habeli, Tropidurus, 137
habelii, Tropidurus, 133, 136, 137, 139, 142, 150-154
(Habelii), Tropidurus pacificus, 136, 150
Hæmatopus frazari, 47
galapagensis, 47-53, 114
niger, 53
Hall, Capt. Basil, 219, 251, 252
Harlan, Richard, 245, 246, 247, 248, 249, 255, 256
Harris, 210, 228, 229, 230, 231
harrisi, Nannopterum, 80-84, 126 (pl. 4)
Hartert (and Rothschild), 7, 18, 35, 38, 42, 55, 58, 96
"Hassler," 135
Hassler Expedition, 226
hawaiiensis, Micranous, 31
Hawk, Galapagos, 36, 52, 77, 91, 108
heermanni, Larus, 45
Helicina (Idesa) **ochsneri, 382**
nesiotica, 382
Heller, 134, 137, 146, 150, 154, 163, 172, 234, 368
Heller (and Snodgrass), 4, 7, 30, 31, 33, 42, 58, 76, 82, 86
Helleri, Opuntia, 7
Helodromas solitarius, 55
helvetica, Squatarola, 53
**hemærodes,** Bulimulus (Næsiotus), 376
"Herald," 226
Hernandez, Col., 220
herodias, Ardea, 58-59, 114
Herodias egretta, 59, 115
Heron, Galapagos, 44, 59, 60, 62-65, 76
Great Blue, 58-59, 69
Green, 65-66
Yellow-crowned Night, 59-62
Heteractitis incanus, 55-56
Heteropygia bairdi, 57
Himantopus mexicanus, 54, 120 (pl. 1)
Hippomane mancinella, 334
Hippopotamus, 207
Holotropis grayi, 172
Grayii, 135, 164
Hood Island Lizard, 159-164
Tortoise, 313-316
hoodensis, Testudo, 244, 259, 293, 313-316
Tropidurus, 136, 138, 159
Hopkins-Stanford Galapagos Expedition, 137
Hudsonian Curlew, 51, 54-55, 56
hudsonicus, Numenius, 54-55
Hull, 24, 33, 228, 229, 230, 231, 232, 233
Hydrochelidon nigra, 41
Hydrometridæ, 37
hyperboreus, Phalaropus, 57
Hypsilophus (Amblyrhynchus) ater, 192
cristatus, 192
(Conolophus) demarlii, 188

I

(Idesa) **ochsneri,** Helicina, **382**
Iguana, Barrington Island Land, 190-192
Land, 188-190
Sea, 192-194
Iguana Cove Tortoise, 344-350
Iguana (Amblyrhynchus) ater, 192
cristatus, 192
incanus, Heteractitis, 55-56
Indefatigable Island Tortoise, 354-362
indefatigabilis, Tropidurus, 136, 137, 138, 172
indica, Testudo, 223, 316, 354
insularis, Tillandsia, 9
interpres, Arenaria, 46-47

J

Jackson, J. B., 255, 256
Jacobii, Tropidurus, 137, 138, 172
Jaeger, Parasitic, 46
Pomarine, 46
Jahnke, Herman, 231
jamaicensis, Creciscus, 14
James Island Tortoise, 319-323, 348
Jervis Island Tortoise, 351-353
**jervisensis,** Bulimulus (Næsiotus), **381**
"Julia E. Whalen," 234

K

Kinberg, 79, 135, 155, 164, 226
Knight, 210

L

Land Iguana, 188-190
Barrington Island, 190-192
Lariformes, 5
Larus franklini, 42
fuliginosus, 42-46
glaucescens, 43
heermanni, 45
occidentalis, 40
Lawson, 222, 223
Least Sandpiper, 56
Leiocephalus, 139
Grayii, 135, 136, 155, 164
lemniscatus, Tropidurus, 136, 137, 138, 155
Levick, Capt., 366

"Lila and Mattie," 228
Limonites minutilla, 56
Linbridge, 228
Liocephalus grayi, 172
Grayii, 136
pacificus, 136, 143, 151
Lizard, Abingdon Island, 143-147
Barrington Island, 168-172
Bindloe Island, 150-154, 159
Charles Island, 164-168
Chatham Island, 154, 155-159
Duncan Island, 147-150
Galapagos, 172-188
Hood Island, 159-164
Loomis, Leverett Mills, 1, 4, 6
**lycodus**, Bulimulus (Næsiotus), **379**

M

macularius, Tringoides, 56
"maculirostris, Anas," 79
magnus, Tropidurus grayi, 137, 138, 172
mancinella, Hippomane, 334
Man-o'-war Bird, 21, 30, 36, 44, 87, 91, 100-104, 105, 109
Mareca Americana, 80
"Mary Sacks," 237
Maytenus, 189
Meek, 244, 316
Megadyptes antipodum, 18
mendiculus, Spheniscus, 5, 16-19, 112, 120 (pl. 1)
mexicanus, Himantopus, 54, 120 (pl. 1)
Micranous diamesus, 29-32, 113
hawaiiensis, 31
microphyes, Testudo, 234, 244, 252-253, 259, 290, 291, 294, 325, 329-344, 348
minutilla, Limonites, 56
Morrell, Capt. Benjamin, 219
Mourning Dove, 9
Myiarchus, 229

N

(Næsiotus) **adelphus**, Bulimulus, **379**
**akamatus**, Bulimulus, **378**
**albemarlensis**, Bulimulus, **377-378**
**alethorhytidus**, Bulimulus, **379-380**
**cucullinus**, Bulimulus, **377**
**cymatias**, Bulimulus, **380**
**elæodes**, Bulimulus, **376**
**hemærodes**, Bulimulus, **376**
**jervisensis**, Bulimulus, **381**
**lycodus**, Bulimulus, **379**
**ochsneri**, Bulimulus, **380-381**
**perrus**, Bulimulus, **376-377**
**rabidensis**, Bulimulus, **381-382**
Nannopterum harrisi, 80-84, 126 (pl. 4)
nanus, Amblyrhynchus cristatus, 192
Narborough Island Tortoise, 299-302
Neboux's Booby, 93, 97
nebouxi, Sula, 93-97, 128 (pl. 5)
nesiotica, Helicina, 382
Nesomimus, 163
Nesopelia galapagoensis, 5, 6-11, 111
niger, Hæmatopus, 53
Night Heron, Yellow-crowned, 59-62
nigra, Hydrochelidon, 41
Testudo, 223, 244, 245, 316, 335
nigrita, Testudo, 244, 249-251, 344, 354
Noddy, 17, 20, 24-29, 30, 32, 98
Clipperton, 20, 29-32, 98, 103, 109
North Albemarle Island Tortoise, 303-305
Northern Phalarope, 57
Noyes, 237
Numenius hudsonicus, 54-55
Nyctanassa violacea, 59-62, 115, 122 (pl. 2)

O

Oates, 93
occidentalis, Larus, 40
**ochsneri**, Bulimulus (Næsiotus), **380-381**
Helicina (Idesa), **382**
Ochthodromus wilsoni, 53
Opuntia, 8, 234, 301, 326, 333
Helleri, 7
Oreocephalus cristatus, 192
Osprey, 33, 193
Oyster-catcher, Black, 53
Frazar's, 47-53, 58

P

pacificus, Liocephalus, 136, 143, 151
Tropidurus, 133, 136, 137, 138, 139, 143-147, 151
pallidus, Conolophus, 133, 188, 190-192
Parasitic Jaeger, 46
Parker, J. J., 2
passerina, Chamæpelia, 9
Passerine Dove, 9
Pelecanus fuscus, 107-110, 118
Pelican, Brown, 25, 44, 107-110
Penguin, Galapagos, 16-19, 81
Yellow-crowned, 18
**perrus**, Bulimulus (Næsiotus), **376-377**
Peruvian Booby, 36, 87, 89-93, 95, 97, 101
"Peterel," 136, 226, 228
Peters, 135, 155
Petrel, Dark-rumped, 36, 98
Graceful, 44, 93, 100
Phaethon æthereus, 104-107
rubricaudus, 107
Phalarope, Northern, 57
Red, 57
Wilson's, 57-58
Phalaropus hyperboreus, 57
phantastica, Testudo, 259, 293, 299-302
phantasticus, Testudo, 4, 244, 299
Phœnicopteriformes, 5

Phœnicopterus ruber, 66-76, 124 (pl. 3)
"Physicien," 244, 316
pictus, Conolophus subcristatus, 188
pilosum, Amblyoma, 235
Pintail, 80
    Bahama, 44, 69, 70, 76-78, 79, 80
piscatrix, Sula, 85-89, 128 (pl. 5)
Pizarro, 209
planiceps, Testudo, 244, 251, 354
plicata, Usnea, 224
Plover, Black-bellied, 53, 56
    Semipalmated, 53, 56
    Wilson's, 53
Pœcilonetta bahamensis, 76-78
Pomarine Jaeger, 46
pomatorhinus, Stercorarius, 46
Porter, 215, 216, 218, 219, 223, 242, 248, 251, 257, 322
porteri, Testudo, 244, 250, 251, 259, 294, 354-362, 364
Porzana galapagoensis, 12
"Potomac," 220, 255
Preliminary descriptions of new species of Pulmonata of the Galapagos Islands, by William Healey Dall, 375-382
Procellariiformes, 5
Puffinus chlororhynchus, 98
pusillus, Ereunetes, 56
Pyrocephalus, 229

Q

Querquedula discors, 79-80
    versicolor, 79
Quoy and Gaimard, 244, 245

R

rabidensis, Bulimulus (Næsiotus), 381-382
Rail, Black, 14
    Galapagos, 9, 12-16
Red Phalarope, 57
Red-billed Tropic Bird, 104-107
Red-footed Booby, 85-89, 93
Red-tailed Tropic-bird, 107
Reynolds, 255
Ridgway, 6, 9, 37, 47, 64
Rogers, Woodes, 211, 226
Rothschild, 228, 237, 238, 244, 245, 246, 254, 257, 258, 313, 323
Rothschild and Hartert, 7, 18, 35, 38, 42, 55, 58, 96
ruber, Phœnicopterus, 66-76, 124 (pl. 3)
rubricaudus, Phaethon, 107

S

sabinii, Xema, 37
Sanderling, 56
Sandpiper, Baird's, 57
    Least, 56
    Semipalmated, 56
    Solitary, 55
    Spotted, 56
Saunders, Howard, 19, 22, 37, 40
Scalesia, 190
sculpturatus, Bulimulus, 381
Sea Iguana, 192-194
Seemann, B., 226
semipalmata, Symphemia, 55
Semipalmated Plover, 53, 56
    Sandpiper, 56
semipalmatus, Ægialeus, 53
Sesuvium, 101
Sharpe, 4
sharpei, Creciscus, 12, 13
Shearwater, Dusky, 44, 91, 93, 110
    Wedge-tailed, 98
Shoveller, 80
Slevin, Joseph R., with John Van Denburgh, Galapagoan lizards of the genus Tropidurus; with notes on the iguanas of the genera Conolophus and Amblyrhynchus, 133-202
Snodgrass, 234
Snodgrass and Heller, 4, 7, 30, 31, 33, 42, 58, 76, 82, 86
solitarius, Helodromas, 55
Solitary Sandpiper, 55
Sooty Gull, 42-46, 76, 93
    Tern, 19-24, 25, 26, 32, 98
Spatula clypeata, 80
Spheniscus mendiculus, 5, 16-19, 112, 120 (pl. 1)
spilonotus, Creciscus, 5, 12-16, 112
Spotted Sandpiper, 56
Squatarola helvetica, 53
Steganopus tricolor, 57-58
Steindachner, 135, 136, 143
Stercorarius crepidatus, 46
    pomatorhinus, 46
Sterna antillarum, 41
    forsteri, 41
    fuliginosa, 19-24, 41
Stilt, Black-necked, 44, 54, 70, 76
stolidus, Anous, 24-29, 41, 113
Stone, 247
Stratton, 211
subcristatus, Amblyrhynchus, 188
Conolophus, 133, 188-190, 191
    pictus, Conolophus, 188
subcristatus, Trachycephalus, 188
Sula brewsteri, 97-100, 117
    cyanops, 84-85, 92, 93, 117
    nebouxi, 93-97, 128 (pl. 5)
    piscatrix, 85-89, 128 (pl. 5)
    variegata, 89-93, 96, 117
Sundevall, 79

sundevalli, Butorides, 62-65, 116, 122 (pl. 2)
Swallow-tailed Gull, 35-42, 106
Symphemia semipalmata, 55

T

Tagus Cove Tortoise, 329-334
Tattler, Wandering, 52, 55-56
Teal, Blue-winged, 76, 79-80
Brilliant, 79
Tern, Sooty, 19-24, 25, 26, 32, 98
White, 32-34
Testudo abingdoni, 259, 290, 293, 296-299
abingdonii, 244, 296, 306
becki, 237, 244, 259, 292, 293, 298, 301, 303-305, 317
bedsi, 303
californiana, 244, 245, 316
chathamensis, 244, 259, 290, 294, 323-328
darwini, 244, 259, 290, 293, 294, 319-323, 348, 353
elephantina, 354
elephantopus, 244, 245-249, 255, 256, 259, 292, 316-318, 335 (as synonym), 344 (as synonym), 354 (as synonym)
ephippium, 234, 244, 251-252, 259, 291, 293, 298, 306-312
gadowi, 257
galapagoensis, 244, 249, 255-256, 257, 292, 316
güntheri, 244, 246, 253, 256-257, 259, 260, 289, 291, 295, 325, 332, 335-343, 344, 348
hoodensis, 244, 259, 293, 313-316
indica, 316, 354
Indica, 223
microphyes, 234, 244, 252-253, 259, 290, 291, 294, 325, 329-334, 348
nigra, 244, 245, 316, 335
nigrita, 244, 249-251, 344, 354
phantastica, 259, 293, 299-302
phantasticus, 4, 244, 249
planiceps, 244, 251, 354
porteri, 244, 250, 251, 259, 294, 354-362, 364
sp. (Barrington), 259, 365-366
sp. (Cowley Mountain, Albemarle), 259, 294, 362-365
vicina, 234, 239, 244, 245, 246, 253-255, 256, 257, 258, 259, 291, 295, 321, 338, 344-350, 353, 354, 364
wallacei, 244, 257-258, 259, 295, 351-353
Tillandsia insularis, 9
Tortoise, Abingdon Island, 296-299
Barrington Island, 365-366
Tortoise, Charles Island, 316-318
Chatham Island, 323-328, 338
Cowley Mountain, 362-365
Duncan Island, 306-312
Hood Island, 313-316
Iguana Cove, 344-350
Indefatigable Island, 354-362
James Island, 319-323, 348
Jervis Island, 351-353
Narborough Island, 299-302
North Albemarle Island, 303-305
Tagus Cove, 329-334, 338, 348
Vilamil Mountain, 335-343
tortuganus, Bulimulus, 377
Trachycephalus subcristatus, 188
Traquair, 251, 252
tricolor, Steganopus, 57-58
Tringoides macularius, 56
Tropic-bird, Red-billed, 104-107
Red-tailed, 107
Tropidurus, 317, 325, 368
abingdonensis, 136, 138
abingdonii, 136, 143
albemarlensis, 133, 136, 137, 139, 143, 168, 172-188
barringtonensis, 133, 139, 143, 168-172
barringtonensis, 137, 138, 168
bivittatus, 133, 137, 138, 139, 142, 155-159
(Craniopeltis) grayii, 155, 164, 172
pacificus, 143
delanonis, 133, 136, 137, 139, 142, 159-164
duncanensis, 133, 136, 137, 138, 139, 143, 147-150
grayi, 136, 147, 155, 159, 172
barringtonensis, 137, 168
grayi grayi, 137, 164, 172
magnus, 137, 138, 172
grayii, 133, 136, 137, 139, 142, 155, 164-168, 172
habeli, 137
habelii, 133, 136, 137, 139, 142, 150-154
hoodensis, 136, 138, 159
indefatigabilis, 136, 137, 138, 172
jacobii, 137, 138, 172
lemniscatus, 136, 137, 138, 155
pacificus, 133, 135, 136, 137, 138, 139, 143-147, 151
(Habelii), 136, 150
Turnstone, 46-47, 53

U

"Uranie," 244, 316
Usnea plicata, 224

V

vallisneria, Fuligula, 80
Vancouver, 211
Van Denburgh, John, The gigantic land tortoises of the Galapagos Archipelago, 203-374
Van Denburgh, John, and Joseph R. Slevin, Galapagoan lizards of the genus Tropidurus; with notes on the iguanas of the genera Conolophus and Amblyrhynchus, 133-202
Van Lidth de Jeude, 291
variegata, Sula, 89-93, 96, 117
"Venus," 135, 226
versicolor, Querquedula, 79
vicina, Testudo, 234, 239, 244, 245, 246, 253-255, 256, 257, 258, 259, 291, 295, 321, 338, 344-350, 353, 354, 364
Vilamil, J., 219, 220
Vilamil Mountain Tortoise, 335-343
violacea, Nyctanassa, 59-62, 115, 122 (pl. 2)
virescens, Butorides, 65-66

W

Wafer, 210
wallacei, Testudo, 244, 257-258, 259, 295, 351-353
Wandering Tattler, 52, 55-56
Watkins, Patrick, 219
Webster, Frank B., 228, 237
Webster-Harris Expedition, 43, 57
Wedge-tailed Shearwater, 98
White, J. W., 2
White Tern, 32-34
Willet, 55
Williamia galapagana, 382
Wilson's Phalarope, 57-58
Plover, 53
wilsoni, Ochthodromus, 53
Wood, 226

X

Xema sabinii, 37

Y

Yellow-crowned Night Heron, 59-62
Penguin, 18
Yupangi, Tupac, 209

## CONTENTS OF VOLUME II, PART ONE

PLATES I—CXXIV

Title-page ..... i

Contents ..... iii

Expedition of the California Academy of Sciences to the Galapagos Islands, 1905-1906

No. VIII. The Birds of the Galapagos Islands, with Observations on the Birds of Cocos and Clipperton Islands (Columbiformes to Pelecaniformes). By Edward Winslow Gifford. (Plates I—VII) ..... 1

(Published August 11, 1913)

No. IX. The Galapagoan Lizards of the Genus Tropidurus; with Notes on the Iguanas of the Genera Conolophus and Amblyrhynchus. By John Van Denburgh and Joseph R. Slevin. (Plates VIII—XI) ..... 133

(Published September 19, 1913)

No. X. The Gigantic Land Tortoises of the Galapagos Archipelago. By John Van Denburgh. (Plates XII—CXXIV) ..... 203

(Published September 30, 1914)

No. XI. Preliminary Descriptions of New Species of Pulmonata of the Galapagos Islands. By William Healey Dall ..... 375

(Published December 31, 1917)

Index ..... 383

December 13, 1926.

PROCEEDINGS

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FOURTH SERIES

VOL. II, PT. I, pp. 1–132, pls. 1–7 AUGUST 11, 1913

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# Expedition of the California Academy of Sciences to the Galapagos Islands, 1905-1906

## VIII

## The Birds of the Galapagos Islands, with Observations on the Birds of Cocos and Clipperton Islands

### (Columbiformes to Pelecaniformes)

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*Assistant Curator of the Department of Ornithology*

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## VIII

## THE BIRDS OF THE GALAPAGOS ISLANDS, WITH OBSERVATIONS ON THE BIRDS OF COCOS AND CLIPPERTON ISLANDS (COLUMBIFORMES TO PELECANIFORMES)

BY EDWARD WINSLOW GIFFORD
*Assistant Curator of the Department of Ornithology*

The Expedition of the California Academy of Sciences to the Galapagos Islands was planned and organized through the untiring efforts of Mr. Leverett Mills Loomis, Director of the Museum of the Academy. Fortunately for the Academy, the Expedition was in the archipelago at the time of the San Francisco earthquake and fire of April, 1906. All of the collections of the Academy in San Francisco were destroyed in that catastrophe, so that the material gathered by the Galapagos Expedition formed the nucleus for the present extensive collections of the Academy, which have likewise been accumulated under the direction of Mr. Loomis. The collection of greatest bulk and importance brought back by the Expedition was, without doubt, the reptile collection, for which the Expedition was primarily organized. The bird collection was also

August 8, 1913

61485

of large size, skins alone numbering 8,691. The unqualified success of the Expedition as a whole was unquestionably due to the ability and sagacity of its leader, Mr. R. H. Beck.

The personnel of the Expedition was as follows: R. H. Beck, chief; Alban Stewart, botanist; F. X. Williams, entomologist; W. H. Ochsner, geologist and conchologist; J. R. Slevin, herpetologist; J. S. Hunter and E. W. Gifford, ornithologists; E. S. King, assistant herpetologist; F. T. Nelson, mate; J. J. Parker, navigator; J. W. White, cook. The scientific members of the Expedition shipped in the capacity of seamen, so that in addition to collecting, the duties attending the working of the vessel likewise fell in a large measure to their lot.

The schooner "Academy," of eighty-seven tons burden, sailed with the Expedition from San Francisco on June 28, 1905, returning on November 29, 1906, after an absence of seventeen months and one day. During the southward voyage ten stops were made, while on the home voyage from Culpepper, Galapagos Islands, to San Francisco none were made. The home voyage was a slow one of sixty-five days. On the voyage south, short stops were made during the month of July, 1905: at Ensenada, San Martin Island, San Geronimo Island, San Benito Islands, Cerros Island, and Natividad Island, Baja California; and at San Benedicto and Socorro, Revilla Gigedo Islands. August 10 was spent on Clipperton Island, Mexico, which was reached only after many days of beating against contrary winds and currents. The early part of September, 1905, was spent at Cocos Island, Costa Rica. On September 13, the schooner set sail from Cocos with the Galapagos Islands as her destination. No intermediate stop was made; although two days were spent sailing down the coast of Ecuador from Perdenales in the Province of Esmeraldas, to Manta and Cape San Lorenzo. At Manta, on September 19, the schooner was put on the westward tack, and stood out along the north coast of the great headland. Hood Island, the southernmost of the Galapagos group, was reached at 9 A. M., September 24, after less than four days' voyage from Manta.

When calm weather afforded the opportunity, a great deal of collecting was done on the ocean, both on the outward voyage and on the homeward voyage, during our numerous jour-

neys from island to island, and also during two extended cruises to the southward of the Galapagos group. Only islands of the Galapagos group, however, are included in the enumeration at the head of the account of each species. In order to give a clear conception of the amount of time and the time of year spent on each island, the following table has been prepared:

DAYS SPENT ON THE VARIOUS ISLANDS OF THE GALAPAGOS GROUP

| Island | Sept. 1905 | Oct. | Nov. | Dec. | Jan. 1906 | Feb. | Mar. | April | May | June | July | Aug. | Sept. 1906 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Abingdon | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 6 | 6 |
| Albemarle | ... | 2 | 4 | ... | ... | ... | 27 | 25 | 3 | ... | ... | 16 | 5 | 82 |
| Barrington | ... | 5 | ... | ... | ... | ... | ... | ... | ... | ... | 3 | ... | ... | 8 |
| Bindloe | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 3 | 3 |
| Brattle | ... | 1 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 1 |
| Champion | ... | 1 | ... | ... | ... | 1 | ... | ... | ... | ... | ... | ... | ... | 2 |
| Charles | ... | 10 | ... | ... | ... | 4 | 2 | ... | 13 | 4 | ... | ... | ... | 33 |
| Chatham | ... | 5 | ... | ... | 7 | 11 | ... | ... | ... | ... | 6 | ... | 4 | 33 |
| Cowley | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 1 | ... | 1 |
| Culpepper | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 1 | 1 |
| Daphne | ... | ... | 2 | ... | ... | ... | ... | ... | ... | ... | 1 | ... | ... | 3 |
| Duncan | ... | ... | ... | 17 | ... | ... | ... | ... | ... | ... | ... | 2 | ... | 19 |
| Enderby | ... | ... | ... | ... | ... | ... | ... | ... | 1 | ... | ... | ... | ... | 1 |
| Gardner-near-Charles | ... | 1 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 1 |
| Hood & Gardner-near-Hood | 7 | 2 | ... | ... | 1 | 6 | ... | ... | ... | 8 | 3 | ... | ... | 27 |
| Indefatigable | ... | 4 | 23 | ... | 11 | ... | ... | ... | ... | ... | 15 | ... | ... | 53 |
| James | ... | ... | ... | 12 | 5 | ... | ... | ... | ... | ... | 5 | 9 | ... | 31 |
| Jervis | ... | ... | ... | 4 | ... | ... | ... | ... | ... | ... | ... | ... | ... | 4 |
| Narborough | ... | ... | ... | ... | ... | ... | 1 | 7 | ... | ... | ... | ... | ... | 8 |
| Onslow | ... | ... | ... | ... | ... | 1 | ... | ... | ... | ... | ... | ... | ... | 1 |
| Seymour | ... | ... | 4 | ... | ... | ... | ... | ... | ... | ... | 3 | ... | ... | 7 |
| Tower | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 3 | 3 |
| Wenman | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 1 | 1 |

In spite of the fact that more time was spent on Albemarle and Indefatigable islands than on any others, the most work remains to be done on those two islands. On Albemarle Island, Banks Bay Mountain, Cowley Mountain, and Iguana Cove Mountain yet remain to be climbed and explored—the last being the loftiest in the archipelago. The vast upland country of Indefatigable Island is in a similarly unexplored state. A third large island, Narborough, is practically untouched. All of the low country and the greater part of the mountain slopes of this island are lava wastes. High up on

the south side, however, there is considerable fertile green country. It was there that Mr. Beck found a very distinct new species of tortoise, *Testudo phantasticus*. As far as birds were concerned, not a single specimen was obtained there. The reasons for the failure of the Expedition properly to explore the mountains on Indefatigable, Albemarle, and Narborough islands, were primarily lack of pack animals, and secondarily lack of proper shelter from the drenching rains and fogs of the mountains. Nevertheless, the collections brought back are more extensive than any heretofore obtained. New territory was explored, and in some instances long journeys of three and four days' duration were made. For instance, on southeastern Albemarle the interior was penetrated for a distance of thirty miles.

The physical characteristics of the Galapagos Islands have been so well described by Messrs. Stewart and Williams in papers of this same series that the reader is referred to their remarks,[1] for the writer has nothing additional to offer. Mr. Stewart's classification of botanical regions has been followed in this paper. In the second part the matter of botanical regions in relation to the birds will be taken up.

Mr. Stewart likewise furnishes a good description of the physical characteristics of Cocos Island,[2] the bird-fauna of which is here treated along with that of the Galapagos Islands. The coral atoll of Clipperton has no land-birds, and hence but little interest attaches to it in connection with a study of the birds of Cocos and the Galapagos Islands. A description of Clipperton Island is omitted, although accounts of the birds are given along with those of Cocos Island and the Galapagos group. For an excellent description of Clipperton the reader is referred to Messrs. Snodgrass and Heller's paper on *The Birds of Clipperton and Cocos Islands*.[3]

For the sake of convenience, Dr. Sharpe's Hand-List of Birds has been followed in the matter of names and sequence of species throughout this paper. The seven species of petrels known to occur among the islands are to be treated by Mr. Loomis in a separate paper.

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[1]See Stewart, A Botanical Survey of the Galapagos Islands, Proc. Calif. Acad. Sci., 4th ser., v. 1, pp. 206-245; and Williams, The Butterflies and Hawk-Moths of the Galapagos Islands, Proc. Calif. Acad. Sci., 4th ser., v. 1, pp. 290-296.

[2]See Stewart, Notes on the Botany of Cocos Island, Proc. Calif. Acad. Sci., 4th ser., v. 1, pp. 375-383.

[3]Proc. Wash. Acad. Sci., v. 4, pp. 501-504.

In the few places where moults and plumages have been discussed, the plan followed is essentially Dr. Dwight's as set forth in various papers. A few changes in names of moults and plumages were necessitated by the fact that the Galapagos Islands are under the equator, and the word "winter" cannot be used to advantage. The appended list gives the order of plumages and moults. The unnumbered plumages and moults placed in square brackets are those peculiar to certain birds, such as some of the *Galliformes,* the *Procellariiformes,* the *Lariformes,* the *Phœnicopteriformes,* and the *Anseriformes.* Wherever the nomenclature differs from that of Dr. Dwight, his is placed in parentheses.

1. Natal Plumage.
2. Postnatal Moult.
   [Second Downy or Postnatal Plumage.]
   [Prejuvenal Moult.]
3. Juvenal Plumage.
4. Postjuvenal Moult.
   [Preliminary Postjuvenal Plumage (Dwight's First Winter Plumage—Preliminary).]
   [Supplementary Postjuvenal Moult.]
5. Postjuvenal Plumage (Dwight's First Winter Plumage; also his First Winter Plumage—Supplementary).
6. First Prenuptial Moult.
7. First Nuptial Plumage.
8. First Postnuptial Moult.
   [First Preliminary Postbreeding Plumage (Dwight's Second or Adult Winter Plumage—Preliminary; Eclipse Plumage).]
   [First Supplementary Postnuptial Moult.]
9. First Postbreeding Plumage (Dwight's Second Winter Plumage; also his Second or Adult Winter Plumage—Supplementary).
10. Second Prenuptial Moult.
11. Second Nuptial Plumage.
12. Second Postnuptial Moult.

The following remarks are necessary in regard to the measurements given. Lengths and extents were taken in the field from specimens before skinning. Wing-measurements are from the "bend" or carpal joint to the tip of the longest primary, the rule being laid along the outer or convex side, and the wing brought up close to it for its entire length. In four cases (*Nesopelia galapagoensis, Creciscus spilonotus, Gallinula galeata,* and *Spheniscus mendiculus*), however, the wing was measured with dividers, one point resting against the anterior side of the bend, the other touching the extremity of the longest primary.

Mr. Ridgway's *A Nomenclature of Colors* was used in determining colors.

In closing, I would say that since April 1, 1904, the day I first began the study of ornithology, there has always been at my hand a gentleman who has never withheld from me the fruit of his own labors. To Mr. Leverett Mills Loomis, as head of the Department and friend, I owe a deep debt of gratitude.

---

### **Nesopelia galapagoensis**: GALAPAGOS DOVE

Abingdon, Albemarle, Barrington, Bindloe, Charles, Chatham, Culpepper, Daphne, Duncan, Gardner-near-Charles, Gardner-near-Hood, Hood, Indefatigable, James, Jervis, Narborough, Seymour, Tower, and Wenman islands.

The Galapagos Dove was common on Hood, Gardner-near-Hood, Duncan, James, and Abingdon islands. On Indefatigable Island it was abundant on the northwestern portion, and common on other parts. On Duncan Island it appeared to be restricted almost entirely to the floors of the two craters. On the remaining islands it was not common—particularly on Chatham, where it was decidedly rare.

The doves appeared to vary in abundance about the springs and water-holes at different times of the year, being more plentiful in the dry season than in the wet. During the latter season they are no doubt dispersed more widely over the country on account of the generally distributed water-supply.

Except on Charles Island, this dove appeared to occur almost entirely in the dry region of the islands. On that island, however, it was found, in all but one instance, about the springs in the rather humid interior. Its presence in the moist region of southern Indefatigable seemed to be governed by the weather; on warm, clear days it was met with, while on overcast, rainy days it was not seen.

Specimens taken on Hood Island, September 25, 1905, showed no particular enlargement of the reproductive organs. Nevertheless, the organs of birds taken on Wenman Island, September 24, 1906, were large, the breeding season for this species being later in the northern than in the central and southern islands—a point also noted in other species.

Except on Wenman Island, the nests of this dove were in small rocky cavities, usually in sloping ground. Eggs and nests were noted as follows:

On April 4, near the top of Narborough Island, at an altitude of about five thousand feet, Mr. Beck found a nest containing one fresh egg. The nest was in a slight hollow in the crevice of a cliff, and was lined with fern-stems and pieces of grass.

On Wenman Island on September 24, 1906, two nests with eggs were found—one with two fresh eggs, the other with two that were incubated. The nests were slight depressions in the ground, lined with grass and protected by the broad leaves of cactus (*Opuntia Helleri*), the plants growing very close to the ground. Mr. Hunter discovered a nest in a like position, and Mr. Beck found one lined with twigs and similarly sheltered on the edge of a sea-cliff. When flushed, the owners of the nests fluttered away as though wounded.

Messrs. Snodgrass and Heller found a nest with one fresh egg on James Island in April, and on Barrington Island they found the doves nesting during the latter part of May.[1] Messrs. Rothschild and Hartert make the following statement: "Mr. Beck writes: '*Nesopelia* was nesting on Bindloe in the last week of March, and several deserted eggs were found on Daphne.' "[2]

It appears that the breeding-season, taken as a whole throughout the archipelago, extends over seven months, from March to September inclusive.

On the rough lava of northeastern James Island, and on the steep tufaceous sides of the larger Daphne Island, a great many deserted nests, crudely lined with grass, were noted in little cavities in the rocks, usually sheltered from the weather by overhanging ledges or shelves.

Young of all ages were seen more or less commonly. On September 19, 1906, Mr. Beck found a partially naked young one, about a week and a half old, in a small cave on the south side of Abingdon Island; while a young bird, scarcely from the nest, was shot on Wenman Island on September 24, 1906. Mr. Beck found two nests with young on the latter island. One contained a naked nestling and an infertile egg, and the

[1] Proc. Wash. Acad. Sci., v. 5, p. 263.
[2] Nov. Zool., v. 9, p. 411.

other a pair of newly-hatched young. Several fully fledged young birds were seen on Hood Island on July 1, and two or three at Academy Bay on July 14. On northwestern Indefatigable, July 21, quite a number were noted among the hundreds of doves feeding about the grassy, tufaceous, coastal region. Two were seen on the south side of Abingdon Island, September 20 and 21, 1906.

The extreme lack of wariness of this species is undoubtedly the cause of its scarcity on Charles, Chatham, and Albemarle islands, where cats are common. On Chatham Island two doves were taken on July 7, while they were feeding in the wagon road. The next day the mutilated remains of one freshly killed were noted beside the road, and also a large black cat not far distant. Another specimen was taken on October 20. On Charles Island they were easy of approach, in spite of the fact that that island has been much frequented by man. From our experience, it would seem that this bird is rather slow in recognizing its enemies. In fact, they were so unsophisticated that we noosed many, and caught many in handnets. One day on Hood Island, Mr. King and I noosed twenty-one. The nooses were of thread, and were fastened to the ends of sticks six or eight feet long. The birds were followed about until an opportune moment arrived, when the noose was slipped over the head of one. We found we were more successful when barefoot than when wearing shoes, as the noise caused by the contact of shoes with rocks startled the birds. The males proved warier than their mates. On northwestern Indefatigable we killed a great many doves for food with sticks and stones.

They were frequently seen during the day, sitting in the trees and bushes and in the tree cactuses (*Opuntia*), and once or twice, during rains, taking shelter beneath overhanging rocks. During a brief interval of sunshine one day, on Gardner-near-Hood, I observed a flock of a dozen or more lying on their sides and stretching one wing up to sun themselves—a common habit among doves.

The daily flights of this bird seemed to take place chiefly in the mornings and evenings, and were evidently made to and from water and roosting-places. Single birds and straggling flocks were seen. Perhaps the largest flight was noted at James Bay, James Island, where, on the evenings of August 6

and 7, scores flew by towards the black lava south of the bay. They flew along the beach and over the water at an elevation of twenty or thirty feet, some much higher, coming from the direction of the lofty promontory at the north end of the bay. Occasionally doves were seen flying from Hood Island to the neighboring Gardner, and *vice versa;* and on July 25 two were encountered at sea flying from Daphne towards Indefatigable.

On the ground, the gait of the Galapagos Dove was similar to that of the Mourning Dove. Its flight, however, was neither as swift nor as graceful. In alighting, a whistling sound was often produced, apparently with the wings.

Their chief food was seeds and occasional pieces of green grass. Once some were seen eating cactus pulp from a fallen tree, and on another occasion several were seen feeding on the ocean-beach among the mangroves.

When killed, considerable water sometimes escaped from their mouths, as was also the case with Passerine Doves (*Chamæpelia passerina*) killed on Socorro, Revilla Gigedo Islands. Their drinking places were found to be rather varied. In some instances they were noted drinking from a tank epiphyte (*Tillandsia insularis*) which grew in the transition and forested moist regions, and which sometimes contained as much as a pint of water. On Bindloe Island they quenched their thirst with the water that condensed about the steam-holes in the craters. On other islands they resorted to springs, ponds, and water-holes, although some of the last at times contained rather salty water.

In passing from the plumage of the young bird, described by Mr. Ridgway,[1] into that of the adult, the first feathers of the adult plumage to appear are the vinaceous-chocolate feathers on the sides of the breast.

In nearly adult birds the last traces of immaturity are shown by a few wood-brown feathers in the breast, by the russet tips and edges of the alula, the primary coverts, and the small feathers along the edge of the wing near the carpo-metacarpal joint, and by the wood-brown edges of the secondaries and tertiaries. In this stage the inner primaries of the immature plumage are usually replaced by those of the adult plumage, while the light rusty margins of the remaining old primaries, characteristic of the young bird, are pretty well

[1]Proc. U. S. N. M., v. 19, p. 617.

worn off and faded. The primaries are therefore not renewed entirely until the adult plumage is practically assumed in all other particulars. Occasionally there are specimens in this stage with old, worn, faded feathers in the forehead. The Academy's series of immature birds contains specimens in all stages of moult.

The postnuptial renewal of the plumage is shown very well by a series of birds from Duncan Island taken in August. A similarly large series taken on that island in December is in rather worn plumage, including primaries. Evidently there is a partial prenuptial renewal of the plumage, for several of these specimens show a few new feathers appearing about the head, the neck, and the interscapular region. A few of the specimens taken on Hood Island in latter September and early October, 1905, give similar evidence. Several birds taken there in early February have well-worn rectrices and remiges, apparently evidencing that these feathers are moulted only annually. These specimens show pin-feathers in the head, breast, abdomen, and back. They are all females, no males being taken at that time.

In adults, as in immature birds, the last trace of moult is in the small coverts near the carpo-metacarpal joint. It is also evident that the young moult into the adult plumage, excepting primaries, at practically the same time (or perhaps a little later,) that the postnuptial moult takes place in the adults. The complete renewal of the primaries seems to be somewhat later, as shown by specimens of nearly adult birds taken on Duncan Island in December. In other words, birds in the postjuvenal plumage are practically indistinguishable from adults in postbreeding plumage.

A male, taken by Mr. Beck on Narborough Island on April 18, is evidently a breeding bird, and is in worn plumage without signs of moult. A female from Jervis Island, December 21, shows a large patch of pin-feathers on one side of the abdomen. This renewal was evidently caused by an accidental loss of feathers.

Birds showing albinistic tendencies were not uncommon, and were collected on Abingdon, Duncan, Gardner-near-Hood, and Hood islands.[1] In one of the most extreme cases in the series, a female (No. 252 C. A. S.), the black of the tertiaries,

[1]See also Bull. B. O. C., v. 10, p. 84.

scapulars, and wing-coverts has been largely replaced by very light gray, while the brown of those feathers is but very little lighter in color than normal. The four outermost primaries of each wing are worn, and are those of the normal immature plumage; while the remaining primaries are fresh feathers of a very pale gray color with darker tips. The tail and tail-coverts are also of an abnormal light gray, and there is a mottled appearance on the breast, due to the partial exposure of the pale bases of the feathers. The iridescent patches on the sides of the neck show feathers subterminally white. The head, however, is normal. Some albinistic specimens have all of the primaries pale gray with darker tips; others are variously, but less conspicuously, marked. The one showing the least abnormal coloration is a bird with several pure-white downy feathers in the abdominal region, completely hidden by the contour feathers. It is perhaps significant that all of the albinistic birds taken are adult, or are moulting into the adult plumage, the albinistic feathers being of that plumage. No albinistic young were found.

The Academy's series of skins of this species numbers 226, ninety-three of which are adult males, and eighty-one adult females. The extreme and average measurements of these in millimeters are as follows: Males—Wing 118–143 (132); tail 63–82 (73); culmen 16–19.5 (17.7); tarsus 22–27.3 (24.5); middle toe 20–25 (23.2). Females—Wing 114–131 (121); tail 55–73 (64); culmen 14.6–18.2 (16.3); tarsus 19.8–24.7 (22); middle toe 18.3–22 (20.5).

Table I, p. 111, shows the measurements of adults by islands. It will be noted that birds from Wenman and Culpepper islands are the largest, a fact noticeable in life. The males from Jervis Island are the longest-billed, and the females from Jervis are, in this regard, second only to females from Culpepper. The sexes are usually recognizable in life, males being decidedly the larger.

The four eggs of this dove possessed by the Academy are pure white in color and elliptical-oval in shape. The egg from Narborough Island measures in millimeters 26.4×20.4. The three from Wenman Island measure respectively 27×20.2, 26×19.7, and 26.3×19.6, the last two being from the same nest.

### Creciscus spilonotus: Galapagos Rail

*Porzana galapagoensis* Sharpe, Cat. Birds Brit. Mus., xxiii, 1894, 113 (Galapagos Archipelago).
*Creciscus sharpei* Rothschild and Hartert, Nov. Zool., vi, 1899, 185 (Indefatigable Island).

Abingdon, Albemarle, Indefatigable, James, Narborough, and Seymour islands.

This rail is scarce on Abingdon, Albemarle, and Seymour islands; fairly common on James and Narborough, and very common on Indefatigable. Occurring both at sea level and at high altitudes, it is found under a variety of conditions, in the mangroves of the littoral region and in the dense and luxuriant vegetation of the moist region.

Two were shot by Mr. Beck on March 17, 1902, among thick ferns near fresh water in the vicinity of Villamil, Albemarle Island. One was taken in a mangrove swamp on the southern end of South Seymour in November, 1905. On Abingdon Island (altitude 1950 feet), it was found during September, 1906, just below the fern-belt which caps the highest portion of the island. In this situation it occurred among small plants about a foot in height, the spreading tops of which grew so close together as to obscure the ground. On Narborough Island, April 4 and 5, 1906, Mr. Beck heard it several times in the tall grass on the rim of the great crater at an elevation of between four and five thousand feet.

On Indefatigable Island, in November and January, this species was taken in the mangroves of the northern coast opposite Daphne, and in the mangroves at Academy Bay. In both places they were fairly easy to shoot, as the ground was not much hidden by the roots of the trees. On the south side of the island, from about 450 to 1100 feet—the highest altitude reached—they were common, and, because of the open spaces under the bushes and trees, quite easy to obtain. Below seven hundred feet they gradually diminished in numbers, owing to the increasing sparsity of the vegetation, and to its transition from humid to arid. In the forests these rails were far from wild, coming very close and peering with their little red eyes into the intruder's face. If a sudden movement or noise was made, they disappeared like a flash. Often many were heard, but few seen. On the first trip inland from Academy Bay, in November, 1905, only twelve were seen;

while on a trip in January, 1906, thirty were taken in one morning. When we traveled through the heavy undergrowth, their cackling calls were heard on all sides. To obtain specimens, it was usually necessary to stand quietly under a tree and clap the hands at intervals. The rails would cackle in response, and, as a rule, the collector would be rewarded by seeing one, or sometimes three or four, step stealthily into the open.

On James Island, in December, January, and August, they were found in the tall grass, which grew abundantly on the main peak (altitude 2,850 feet). It was a much more difficult matter to capture them than on Indefatigable Island, a long hunt often furnishing only one, or none at all. They traveled through little runways in the grass, and often, when seen, were too close to shoot. Their call notes were similar to those of the rails of Indefatigable Island, and they also responded to the clapping of hands.

The reproductive organs of specimens taken in November, 1905, on Indefatigable Island, and in early January, 1906, on James Island, were somewhat enlarged. A female taken by Mr. Hunter on Abingdon Island on September 21, 1906, contained a well-developed egg, and a male and a female taken by Mr. Beck had enlarged sexual organs.

There is great variation in the degree of white markings on the lower parts, and on the wing-coverts, back, rump, and upper tail-coverts. The three specimens from Abingdon Island are very sparsely spotted, while the specimen from South Seymour is pretty heavily marked. Birds from Indefatigable and James islands show about an equal range of variation—from specimens with practically no spots on the upper parts, to those that are heavily spotted. Both sexes vary equally in this regard.

The characters[1] given to distinguish *Creciscus sharpei* from *Creciscus spilonotus* break down in the Academy series. These characters are: a slight difference in the shade of brown of the back, with difference in size and in amount of white spotting. The James Island rails average slightly larger than those from Indefatigable Island, as is shown in Table II, p. 112.

The male from Abingdon Island measured in the flesh 157.8 mm. in length, and 241.3 in extent; while the only male from

[1]Nov. Zool., v. 6, p. 185.

Indefatigable Island so measured proved to be 145 mm. in length, and 228 in extent. Two males from James Island were 160 and 156 mm. in length, and 245 and 240 in extent. A female from Indefatigable Island was 138 in length, and 231 in extent; while a female from James Island was found to be somewhat larger, being 150 in length, and 240 in extent. No others were measured in the flesh.

The Academy's series of skins of this species numbers seventy-nine, thirty-nine of which are males, thirty-eight females, and two unsexed. Extreme and average measurements in millimeters are as follows: Males—Wing 61–72 (68.3); tail 20–26 (24.6); culmen 15–17.7 (16.13); tarsus 19.5–23.4 (21.53); middle toe 22–26 (24.2). Females—Wing 61–72 (66.6); tail 21–27 (23.6); culmen 14.7–16.6 (15.46); tarsus 19.7–22.6 (21.28); middle toe 21.8–25.4 (24).

Measurements in millimeters of a series of nine Black Rails (*Creciscus jamaicensis*), consisting of one male and eight females from about San Francisco Bay, California, are as follows: Male—Wing 66; tail 29; culmen 15.1; tarsus 19.5; middle toe 20.8. Females—Wing 65–68 (66.6); tail 29–34 (30.9); culmen 13–14.8 (14); tarsus 18.1–19.8 (19.04); middle toe 19.5–21 (20.46).

Comparing the average measurements of the Galapagos Rail with those of the Black Rail, it appears that the length of wing of the two species is practically the same, while in length of tail the Black Rail exceeds the Galapagos Rail by several millimeters, in spite of the fact that it is a smaller bird otherwise; viz., in length of culmen, length of tarsus, and length of middle toe. In other words, the bill and feet of the Galapagos Rail are larger in proportion to the other parts than are the corresponding members in the Black Rail. In the Black Rail, the development of wing and tail, as compared with that of the bill and feet, is much greater than in the Galapagos Rail.

The following remarks on the moults and plumages of the Galapagos Rail are made after a thorough study of the material in hand.

One male and two females from Abingdon Island show some wear, but no sign of moult. These specimens all had enlarged sexual organs, and were taken in September, which

is apparently the beginning of the breeding-season of this species there.

A male taken on Seymour Island, on November 22, shows wear, but the feathers of the breast seem to be fresh, and among them are a few just bursting from the sheath. A few pin-feathers are to be found among the scapulars.

All of the December and January specimens from James Island show a mixture of fresh and somewhat worn feathers in the body-plumage. In some specimens a few new brown feathers are just appearing from their sheaths in the anterior part of the brown mantle, and other new feathers are appearing in the sides of the breast. There is perhaps a prenuptial renewal of feathers in certain tracts, as apparently indicated by the above facts, for the specimens were obviously taken before the breeding-season; or else they indicate a somewhat belated postnuptial moult. Age may also be a factor. Three August specimens are very much worn.

The results of an examination of sixty-three specimens from Indefatigable Island, taken in November, 1905, and in January and July, 1906, may be summarized as follows:

November specimens, as a rule, show a mixture of fresh and somewhat worn feathers. Pin-feathers are appearing in the anterior part of the brown mantle in a few specimens. Some also show new feathers in the breast as well as in the back. An occasional specimen, such as No. 271, seems to be in entirely fresh plumage, including wing-coverts, which in practically all other specimens seem to show wear. Whether the new feathers, which are appearing in some, are the last of a postnuptial moult or the first of a prenuptial moult, is difficult to say. Again I am unable to tell what part age plays in the scheme of moults.

With one exception, twenty-seven specimens from Indefatigable Island, taken in January, exhibit no signs of moult; but all show wear in varying degree. These specimens are evidently in about the same category as the three specimens from Abingdon Island above mentioned. The one exception has pin-feathers in the back and in the sides of the breast.

Specimens from Indefatigable Island, taken in July, are assuming fresh plumage, and in most cases pin-feathers are still in evidence in the back and in the breast. In the majority of cases the new dress has been quite completely donned.

The examination of specimens for signs of moult brought to light five cases of feathers lacking pigment. In each bird so affected there was but one white feather; in four of the cases the feather was in some part of the neck, and in the fifth in the breast. Four of the specimens are from Indefatigable Island and one from James. The bird from James was taken in December, and the birds from Indefatigable, in November, January, and July.

### Gallinula galeata: FLORIDA GALLINULE

Albemarle and Chatham islands.

Florida Gallinules proved to be tolerably common in the large salt-water lagoons fringed with mangroves, in the vicinity of Villamil, Albemarle Island, in November and August. They were wary and secretive. Usually they kept out of gunshot, and not more than two or three were seen at a time. An apparently immature male was shot by Mr. Hunter on a fresh-water pond at about one thousand feet elevation near Progreso, Chatham Island, on October 17.

In a high-plumaged male taken on southern Albemarle on March 6, the amount of white on the edge of the wing is extensive, but it is equaled in a specimen from Merced County, California. The tarsi of the Galapagos bird, however, have dried of a variegated orange-and-red color, while those of the California examples have dried chiefly of a dark olive-green.

The measurements in millimeters of the adult male from the Galapagos Islands are as follows: Wing 183; tail 73; culmen and frontal shield 47; greatest width of frontal shield 15.3; tarsus 53; middle toe 64.

The extreme and average measurements in millimeters of a series of seven adult males from Merced County, California, are as follows: Wing 175–190 (182); tail 70–74 (72); culmen and frontal shield 40–44.9 (42.4); greatest width of frontal shield 10.2–15 (13.1); tarsus 48–57 (53.1); middle toe 63–70.7 (65.8).

### Spheniscus mendiculus: GALAPAGOS PENGUIN

Plate I, Fig. 1

Albemarle, Brattle, Charles, Duncan, James, Jervis, Narborough, Onslow, and Seymour islands.

The chief rendezvous of this penguin was Iguana Cove, Albemarle Island, where it was not unusual to see thirty or forty at a time. Several were seen at each of the following places, viz.: Cormorant Bay, Post Office Bay, and Black Beach Roads, Charles Island; northeastern Duncan; the west side of South Seymour; the east, north, and west sides of James Island; the east and north sides of Narborough; and at Banks Bay and Tagus Cove, Albemarle Island. One was seen on the northeastern side of Jervis, and another on Onslow. None were seen at Seymour in November, 1905, when the surf along the rocks was quite heavy; but in July, 1906, when the bay was tranquil, a few were noted. Careful search will probably show that this species occurs north of the equator, as it is not rare a few miles to the southward.

At Iguana Cove it was common to see eight or ten together on one rock, at other places never more than two or three. As a rule they could be approached closely. One was caught at Cormorant Bay on a flat rock several feet from the water. When seized, it turned on its captor with a snarl, and tried to bite. At Banks Bay a picture of three on a rock was taken at a distance of about ten feet. They evinced considerable curiosity, one swimming off a short distance and then returning to have another look.

In getting over the rough rocks the Galapagos Penguin uses both flippers and feet. The bird which was caught at Cormorant Bay and kept alive several days, sat upright most of the time. When moving about on deck, it progressed by small jumps, with its head and neck bent forward and downward, giving it a stooping appearance. In climbing a beam six inches high, it used its flippers as arms, placing them on top of the beam, and raising itself with the additional aid of its feet.

Small fish, up to four inches in length, constituted the food of this species so far as discovered. Often, when fishing, penguins would be followed closely by a small flock of Noddies, which would hover over them excitedly when a catch was made.

Nothing definite is known of the nidification of this species. A nest of sticks laid loosely together on the floor of a cave at Iguana Cove, was attributed to it. As additional evidence might be mentioned the fact that three birds were seen to enter

a small inaccessible cave, which had its opening at the water's edge. Two females taken at Iguana Cove on March 21, 1906, contained well-developed eggs.

Nearly all of the specimens taken were very fat, and occasionally a bird was taken in which the webs of the feet were slit. In an immature specimen (No. 342 C. A. S.) the anterior edge of each flipper shows a healed injury, which in the right flipper is a deep indentation. Each of these injuries appears to have been caused by a severe bite when the bird was small.

The description of the immature plumage by Messrs. Rothschild and Hartert[1] fits four of the Academy's specimens exactly. The measurements of the Academy's series of thirteen adults, however, do not confirm their statement that "The *female* differs from the *male* at a glance in being much smaller." A large male might be distinguished from a small female, but a medium-sized or small male could not be distinguished from a large or medium-sized female.

Every specimen in the Academy's series of seventeen exhibits anywhere from two to about thirty-three dusky feathers among the pure-white ones of the breast and abdomen. An apparently similar condition, attributed to melanism, is stated by Sir Walter Buller[2] to exist in certain specimens of the Yellow-crowned Penguin (*Megadyptes antipodum*).

None of the specimens in the Academy's series show moult in progress. When in worn feather, the dusky portions of the plumage assume a brownish cast, while in fresh plumage they are grayish. Table III, p. 112, gives the general condition of the plumage of each specimen, as well as the measurements of the specimen in millimeters.

In the flesh, No. 343 measured 480 mm. in length, and 375 in extent; while No. 354 measured 490 in length, and 394 in extent.

The extreme and average measurements in millimeters of the adult males and females follow: Males—Flipper 149–166 (156); tail 23–39 (27); culmen 57.4–61.1 (60.2); tarsus 26–31.6 (29); middle toe and claw 56.8–62.5 (60.2). Females—Flipper 140–155 (149); tail 19–30 (26); culmen 56–57.4

[1]Nov. Zool., v. 6, p. 199.
[2]Supplement Birds N. Z., v. 1, p. 94.

(56.7); tarsus 25.7–29 (27.2); middle toe and claw 56.3–60.7 (59.1).

The colors of the naked parts of the adults in life were as follows: Upper mandible mostly black; lower mandible blackish, becoming fleshy pink at base; iris claret-brown; feet black, usually mottled with grayish white.

### Sterna fuliginosa: Sooty Tern

Crossman, Culpepper, and Wenman islands.

Although confined almost exclusively to Culpepper and Wenman islands and their vicinity, this tern was observed near the Crossman Islands on August 19, 1906. None were seen at Wenman on September 24, 1906, although they have been reported from that locality.[1] Several, however, were heard during the night between that island and Culpepper. On the north side of Culpepper on the following day, the air swarmed with these birds, most of them flying very high, and, judging by the incessant twittering sound which reached our ears, apparently all calling. This species nests on the top of Culpepper Island, which is inaccessible on account of the high cliffs on all sides.

During September, 1905, from latitude 3° 6′ North, longitude 84° 9′ West, southeast to Manta, Ecuador, and from there west to the Galapagos Islands, no Sooty Terns were seen. South of the Galapagos Islands during the months of May and June, 1906, they were met with three times:

May 8, latitude 2° 29′ South, longitude 90° 4′ West—one.
June 9, latitude 3° 39′ South, longitude 93° 1′ West—two.
June 13, latitude 3° 6′ South, longitude 91° 26′ West—one.

Inasmuch as we were cruising off and on south of the archipelago, for two months, we had ample opportunity for observation. The almost total absence of this species in this region and off the coast of Colombia and Ecuador as far south as Manta bears out Mr. Saunders' statement that it is "Almost unknown on the South American side of the Pacific."[2]

On the voyage from San Francisco to the Revilla Gigedo Islands, the Sooty Tern was met with on two occasions. On

[1] Nov. Zool., v. 6, p. 191.
[2] Cat. Birds Brit. Mus., v. 25, p. 110.

July 20, 1905, the first one was seen about noon, when in latitude 25° 56′ North, longitude 114° 11′ West. A young one was seen five days later, the schooner's position then being latitude 19° 37′ North, longitude 111° 11′ West.

The first breeding-place of this species visited was Oneal Rock, near Socorro, Revilla Gigedo Islands. There, on July 27, 1905, they and the Noddies were about equally abundant, thousands flying overhead as Mr. Beck and I landed on the rock. Whenever a shot was fired they arose in a cloud, and the calling was incessant. No fresh eggs of the Sooty Tern were discovered, but a number of well-feathered young were taken.

After leaving the Revilla Gigedo Islands, the species was not again encountered until in latitude 10° 43′ North, longitude 109° 10′ West, on August 3, 1905, when about a dozen were seen. This was in the vicinity of Clipperton Island, Mexico, where this tern breeds abundantly. They were seen quite commonly every day after that, while we were beating back and forth against contrary winds and currents in an attempt to reach the island, which we finally succeeded in doing on August 10. Very frequently the Sooty Terns were fishing in company with other birds such as Brewster's Boobies, Noddies, Clipperton Noddies, and Blue-faced Boobies, and often all were mixed indiscriminately in one large flock.

Messrs. Beck and Hunter reported Sooty Terns nesting by thousands on several low, flat islets in the brackish lagoon at Clipperton Island. On one islet, about eight hundred square feet in area and ten inches in elevation above the water of the lagoon, there were over a thousand eggs. They were laid on the bare coral with no semblance of a nest, and were so closely placed that it was necessary to step with extreme care to avoid crushing them. The owners were very fearless, and allowed themselves to be handled freely. They were also very noisy, and kept up a great din. On the 9th four hundred eggs were collected by the two residents of the island from a space twenty by twenty feet, and by 11 A. M. on the 10th over one hundred fresh ones had been laid in the same area.[1] The week before we arrived, a rise in the water of the lagoon had submerged some of the lower islets, ruining

[1]Cf. Hull, Birds of Lord Howe and Norfolk Islands, P. L. S. N. S. W., v. 34, p. 653.

hundreds of eggs. In addition to a large number used for food, we preserved 379, representing as many sets. A number of downy young of various ages were also taken.

After leaving Clipperton, Sooty Terns were not often observed, only six being seen on the voyage to the Galapagos Islands:

August 16, latitude 8° 1′ North, longitude 105° 22′ West—one.

August 19, latitude 7° 21′ North, longitude 103° 40′ West—one.

August 26, latitude 3° 41′ North, longitude 94° 16′ West—two.

September 2, forty miles south of Cocos Island, Costa Rica—an immature male taken.

September 16, latitude 3° 6′ North, longitude 84° 9′ West—an immature one.

On the homeward voyage Sooty Terns were observed twice. The first instance occurred on September 27, 1906, two days after leaving Culpepper, our position being latitude 5° 34′ North, longitude 95° 27′ West. About noon a flock of thirty or forty, with three or four Man-o'-war Birds following them, were seen working in a southeasterly direction. The second instance occurred on October 18, in latitude 16° 55′ North, longitude 112° 55′ West, when a single individual flew by the vessel.

Fifty-two skins of this species were brought back, twenty-seven of which are adult. Fourteen are downy young of various ages from Clipperton Island. The remaining eleven are immature birds. Of these, seven are in the dusky juvenal dress; with buff tips to the dorsal feathers posterior to the hind neck, and vinaceous-cinnamon tips to the under tail-coverts. They were taken from nests on Oneal Rock, and, although their wings were not full grown, they were probably able to fly. An immature male (No. 1351 C. A. S.) taken in latitude 19° 40′ North, longitude 112° West, on July 25, 1905, shows considerable dark coloration below and on the sides of the head, and is evidently going through the first prenuptial moult. The old dorsal feathers are so worn that it is impossible to distinguish any pale tips. At any rate the new scapu-

lars and interscapulars are dark gray with conspicuous white tips. New inner primaries, new upper wing-coverts, new tail-coverts, and new feathers on the under parts and about the head are also appearing. Some alternation is manifested in the replacement of the upper wing-coverts. An examination of the tail shows the two inner and the two outer rectrices to be new. The outer ones are not those of the full adult, but are dusky save for a terminal whitish spot on the outer web.

No. 1350 C. A. S., male, from forty miles south of Cocos Island, September 2, 1905, is very much like the bird just described, and has in addition some whitish streaking on the fore part of the crown. This specimen seems to exemplify more fully the plumage developed during the first prenuptial moult. The three outer primaries of one wing and the two outer of the other have not been replaced, nor have the two rectrices nearest to each of the outermost rectrices. Nos. 1348 and 1349, taken near Clipperton Island on August 5 and 8 respectively, are adult in every particular, save for a few dark feathers in the lower parts.

The fourteen downy nestlings collected on Clipperton Island on August 10, show some variation in age and size, which can perhaps be best indicated by the measurements of the culmen and tarsus of the largest and the smallest. Largest: Culmen 15.6 mm.; tarsus 17.1 mm. Smallest: Culmen 11.8 mm.; tarsus 13.9 mm. All exhibit the egg-tooth. Mr. Saunders' description of a chick[1] about three days old does not quite describe the conditions which exist in the Academy's series of chicks. The specimens are "streaked with grayish brown and dull white on the upper surface," but the white down is tipped with rufous. All the down of the upper surface appears as though the ends of the filaments of each tuft were twisted together, giving the surface a bristled appearance. There is more or less variation in the relative amounts of dark and light coloring, producing accordingly either a darker or a lighter dorsal aspect.

Two adults from the Revilla Gigedo Islands are in plumage quite worn, and show new feathers appearing in the back, among the upper wing-coverts, and in the breast. In one specimen the moult of the body-plumage is more advanced

[1]Cat. Birds Brit. Mus., v. 25, p. 109.

than in the other, although both were taken on July 27, 1905. New proximal primaries are appearing in both, and in one, new middle rectrices. In the other, the outer rectrices are appearing first. Undoubtedly this is the postnuptial moult, as proved by the presence of a few large-sized young on the nesting-site.

The Clipperton Island adults, taken during the first half of August, 1905, are all in somewhat fresher plumage; for the breeding-season was not over, as it was at Oneal Rock. With one exception, none show signs of feather-growth. In No. 1330 C. A. S., a few new interscapulars are appearing, their bases being still enveloped in the sheath.

Extreme and average measurements in millimeters are as follows: Fifteen adult males—Wing 275–295 (285); tail 142–194 (168); culmen 40–44.5 (42.4); tarsus 20.6–22.9 (21.9); middle toe 17.5–21.5 (20). Twelve adult females—Wing 278–300 (288); tail 170–216 (189); culmen 40–43 (41.2); tarsus 20.7–23 (21.6); middle toe 18.4–20.9 (19.6).

The following lengths and extents in millimeters were taken by Mr. Beck from birds in the flesh. The lengths of four males were 390, 450, 455, and 465; the extents were 838, 880, 882, and 899. A female measured 460 in length, and 870 in extent.

The following remarks are based entirely upon the series of fresh eggs collected on Clipperton Island, August 10, 1905.

They vary a great deal in shape, the majority being ovate, elliptical-ovate, and elongate-ovate. The rarer shapes are short-ovate, cylindrical-ovate, oval, elliptical-oval, and nearly ovate pyriform.

The ground color is likewise subject to great variation. The majority of the eggs vary in this regard from white to cream-color, cream-buff, and pinkish buff. In a number of cases the white ground color has a slight bluish cast. One abnormally-colored egg has a vinaceous-cinnamon ground with cinnamon-rufous spots and blotches, and suffused dull purplish blotches which appear to be beneath the surface. Another is vinaceous-buff, with bay spots of varying size and the usual faint suffused blotches. Still another is pale vinaceous-buff, almost immaculate save for several dark brown spots at the larger end, and a few pale suffusions. All of the eggs of the

series have these faint spots and blotches of dull purplish or brownish, which appear to be below the surface, just as though a coat of the ground color had been put over them.

The external spots and blotches vary greatly in size, number, and color. In size they range from minute dots to blotches the area of a dime. In number they vary greatly—some eggs being dotted over the entire surface, others being marked with both large and small spots, others with a few large spots and blotches, and in addition to these styles there is every conceivable sort of intermediate. However, no absolutely immaculate eggs occur in the series. As a rule, the markings are heaviest at the larger end of the egg, and very often the majority of the spots are at that end. In some specimens they are most numerous just below the larger end, forming sort of a wreath or zone.

The markings of a single egg may vary much or little in color. Usually there are several different shades of brown and reddish brown on a single specimen. In one case the markings range from cinnamon to seal-brown. In specimens with a white ground they partake more of brown than of red, while in specimens with a cream ground the reverse is true. On three or four specimens the reddish brown markings have a blurred aspect. Mr. A. F. Basset Hull, in his paper on *The Birds of Lord Howe and Norfolk Islands,* describes and figures similar variations.[1]

Three hundred and seventy-six eggs in the Academy's series yield the following extreme and average measurements: Length 44–59.2 mm. (50.6 mm.); breadth 33.2–38.5 mm. (35.9 mm.).

### Anous stolidus: NODDY

Abingdon, Albemarle, Barrington, Bindloe, Brattle, Champion, Charles, Chatham, Culpepper, Dalrymple, Daphne, Duncan, Gardner-near-Charles, Gardner-near-Hood, Hood, Indefatigable, islet off northeast James, James, Jervis, Nameless, Narborough, Onslow, Seymour, Tower, and Wenman islands.

Noddies of the indigenous dusky variety were quite common throughout the archipelago, and were seen on the surrounding sea to a distance of about sixty-five miles.

[1] P. L. S. N. S. W., v. 34, p. 655, pl. 50.

They nested in crevices and holes, and on ledges of cliffs and caves, not more than thirty feet above the water. The single egg was usually placed in a slight depression, and surrounded by a few bones, seaweed, sticks, remains of crabs, and feathers, which composed the nest.

This species has been found breeding on Albemarle Island in February, March, and April; on Culpepper in July and September; on Hood in February; on Indefatigable in January; and on James in April—in all, during six months of the year. Eggs about to be laid were taken from birds captured at Academy Bay, Indefatigable Island, on January 22, and at Tagus Cove, Albemarle Island, on April 6 and 9.

Of four nests examined at Tagus Cove on March 24, one contained an egg in an advanced stage of incubation, another contained a lively chick two or three days from the shell, and the remaining two contained pretty well-developed young. The same day two young birds just able to fly were shot. A young one was taken from a nest on Culpepper Island on September 25, 1906.

It was not uncommon to see a Noddy sitting on the head of a Brown Pelican, while the latter was resting on the water swallowing fish. Once I saw two on a pelican's head at one time. Several often accompanied the young pelicans in their excursions along the coasts.

On the outward voyage from San Francisco in 1905, the first Noddies were met with on July 24 in latitude 19° 40′ North, longitude 112° West, several passing us that evening. A few were next seen along the coast of Socorro, Revilla Gigedo Islands, on July 27. That same day we visited Oneal Rock, which lies about a mile from Cape Henslow, Socorro. There Noddies and Sooty Terns were assembled in thousands. Only Noddies seemed to be nesting, and they were found all over the rock, each egg being deposited in a little depression. We caught many adults with our hands, while they were sitting on their nests, in addition to two well-feathered young.

After leaving the Revilla Gigedo Islands, Noddies were again seen on July 31 in latitude 13° 47′ North, longitude 109° 15′ West. In latitude 10° 43′ North, longitude 109° 10′ West, on August 3, one came aboard the vessel in the evening.

We landed on Clipperton Island, Mexico, on August 10. I worked about Clipperton Rock, where Noddies were nesting commonly, and were as unafraid as on Oneal Rock. Messrs. Beck and Hunter, who landed on some of the islets in the lagoon, stated that both this species and the Sooty Tern were nesting abundantly, and they obtained eggs and young of both.

Between Clipperton Island and Cocos Island, Costa Rica, the first certainly identified Noddies were seen on September 1, about thirty miles south of Cocos. An immature one was taken on the following day.

During our thirteen-day stay at Cocos Island, the Noddy was common along our route of travel by water between Chatham Bay and Wafer Bay. There was usually a good-sized flock on the point opposite Nuez Island, and also a colony on the small island between Nuez and Cascara islands. A small nesting colony was located on a rock near Conic Island. Their nests consisted of a few twigs, and were occupied by young birds which, with one exception, were nearly able to fly.

The Academy's series of skins of this species numbers 132. A downy young one from Clipperton Island is entirely white, save for a few black contour feathers appearing on the back, crown, and sides of the breast. The black feathers are tipped with white down. The only specimen in the down from the Galapagos Islands is of a brownish-gray color all over, shading into a paler gray on the abdomen, in contradistinction to the downy young one from Clipperton Island. This fact probably has no geographic significance, for young in both white and black natal down are found in the same colony.[1]

Two young from Oneal Rock are fairly well feathered except for the throats, which are covered with white downy teleoptiles. In one specimen the contour feathers appearing in the throat are tipped with grayish downy neossoptiles, and in the other with white. All of the young from Cocos Island are pretty well feathered, but show both white and gray down at the tips of the feathers, while the downy teleoptiles are pale gray in most cases.

Four specimens, Nos. 1439, 1473, 1475, and 1501, taken at Tagus Cove on April 5 and 7, were at that time going through

[1]Watson, Papers Tortugas Lab. Carnegie Inst. Wash., v. 2, p. 237, footnote, plate 4 (Watson).

what is probably the first prenuptial moult, involving the wings as well as the body. The newly-acquired feathers of the top of the head are darker than those of adults taken at the same time, and the ventral aspect of the body-plumage is browner.

Five adults from Oneal Rock, taken July 27, 1905, are in nuptial plumage somewhat abraded, and showing no indications of recent feather-growth, except in one case, where a pin-feather was found in the side of the neck.

Nine adults from Clipperton Island were taken on the breeding-ground, August 10, 1905. In No. 1416, male, the moult is in full progress. New primaries have replaced all but one of the old; new tail-feathers and new body-feathers are appearing. The white downy teleoptiles beneath the contour feathers are also being shed. Six other specimens show the moult under way; in the most it is just started, two or three pin-feathers usually appearing at the base of the hind neck. Two remaining specimens show no moult and are comparable to the specimens from Oneal Rock. Without a doubt, the moult which is beginning is the postnuptial. Two individuals taken at sea near Clipperton Island on August 8, are in the same stage as those from the island; one shows considerable new feather-growth, while the other exhibits but one pin-feather.

No. 1412, captured on August 3, ten miles north of Clipperton Island, has a great many remarkably abraded and faded feathers in the back, wings, and under parts. The new plumage is that of the adult, as shown by the feathers of the top of the head. The question is whether the worn feathers are of an immature or of an adult plumage, also whether the bird has not skipped a moult, or at most undergone only a partial moult. The extremely dilapidated condition of the old feathers would seem to indicate something of the sort. Furthermore I can find no feathers that may be attributed to a plumage appearing between the much worn one and the present new one.

In adults from Cocos Island taken during the first half of September, 1905, the postnuptial moult is in progress; primaries and rectrices are being renewed in some instances, as well as the body-plumage. In certain cases the moult is just starting.

The results of an examination of a series of adults from the Galapagos Islands may be summarized as follows:

A pair taken on Hood Island in latter September, 1905, seem to be just completing a moult which has involved the entire plumage. I cannot say whether it is prenuptial or postnuptial.

Eight specimens taken at Brattle Island on October 30, show, in the majority of cases, some feather-renewal about the head, back, and breast. The primaries and rectrices in all show varying degrees of wear. Apparently a moult is beginning, and it is likely that it is prenuptial, since the species has been found breeding on other southern and central islands in January and February. To six November specimens taken at Indefatigable and Daphne islands the same remarks are applicable. In one a new lateral rectrix is appearing.

A male from Duncan Island, December 6, shows no feather-growth and very little abrasion.

Fourteen January specimens, one from James Island and thirteen from Indefatigable, are evidently in nuptial plumage, and show no signs of feather-growth except in three specimens from Indefatigable. One is evidently a brooding male, and shows two new feathers appearing in the anterior part of the abdominal region; a second shows a new tail-feather and one or two new interscapulars; while in the third specimen the moult has gained considerable headway in the ventral tract.

A male from Hood Island, February 1, is evidently in nuptial dress.

On March 20 eleven adults were taken at Iguana Cove, Albemarle Island. All are in fairly fresh plumage, about half of them showing no pin-feathers. Of those with pin-feathers, two or three are getting new inner primaries.

A male from Tagus Cove, captured March 24, shows renewal of the primaries, rectrices, lesser wing-coverts, and body-plumage.

Nineteen examples from Tagus Cove, shot during the first half of April, show the postnuptial moult under way, and involving in most instances the wings as well as the body-plumage.

A female from south Albemarle, April 28, is undergoing a moult of the body-plumage, probably postnuptial. All but the two outer primaries of each wing have been renewed. A fe-

male, taken May 9 in latitude 2° 20′ South, longitude 90° West, is in a somewhat similar condition.

A male, captured on May 21 at sea south of Duncan Island, is in worn plumage, but with renewals taking place both in the body-plumage and in the flight-feathers. Two males from Indefatigable Island captured in July, are in a like state; but the replacement has progressed farther.

In all cases the pin-feathers appear black in contrast to the feathers of the disappearing plumage.

The Academy's series of adults, forty-six males and fifty-three females, gives the dimensions in millimeters of the species as follows: Males—Wing 250–291 (279); tail 136–173 (161); culmen 37.5–43.6 (40.8); tarsus 21.6–25.5 (24.2); middle toe 27.6–33 (31). Females—Wing 249–280 (272); tail 131–167 (155); culmen 35.5–42.8 (39.3); tarsus 21–25 (23.4); middle toe 27.3–31.7 (29.8).

Table IV, p. 113, shows the measurements of adults from the four localities visited. The Galapagos specimens average somewhat smaller in certain respects than their northern relatives.

Four males from the Galapagos Islands measured in millimeters in the flesh as follows: Lengths 396, 400, 401, 440; extents 824, 839, 845, 855. Six females from the same locality measured: Lengths 380, 380, 392, 396, 400, 400; extents of five 784, 809, 813, 813, 821.

The Academy's series of seventy-eight eggs exhibits no noteworthy variation in either coloration or form. It shows the variation in size to be: Length 47.4–56 mm. (51.1 mm.); breadth 32.2–38.5 mm. (35.5 mm.).

### **Micranous diamesus**: Clipperton Noddy

This species was often seen in company with the Noddy, and in many cases, when the birds were seen at sea, it was impossible to distinguish the species with certainty.

On August 7, 1905, off Clipperton Island, Mexico, the first Clipperton Noddy was observed, and on the 9th the species was again certainly identified.

On August 10, Clipperton Island was visited, and this species was found nesting very commonly on Clipperton Rock. The nests, built of algæ from the lagoon, were placed on little

juttings of rock on the walls of the cliffs and of caves, and sometimes they were built on top of old nests. They were all damp, and about two-thirds of them contained eggs, some of which were incubated. Of eight eggs collected, two were fresh, while in the remaining six incubation had begun. With this species one egg constitutes a clutch. The owners were all lacking in timidity and several were caught by hand.

On September 1, 1905, the Clipperton Noddy was met with about thirty miles south of Cocos Island, Costa Rica, and the following day one was captured.

During our stay at Cocos Island in the first half of September, this species was found commonly along the shore line between Chatham and Wafer Bays. Three were seen flying up the fresh-water creek at Wafer Bay. They roosted in the trees as well as on the rocks along the shores. Individuals often circled about the small boat four or five times, keeping too close for shooting. Like the Noddy this species is quite readily decoyed to wounded birds. So far as noted neither species dives for its food. In two instances Man-o'-war Birds were seen in pursuit of Clipperton Noddies.

Messrs. Snodgrass and Heller[1] report this species as nesting in the tall trees near Chatham Bay in July. During our stay in September, young, a-wing, appeared to be more numerous than adults, evidencing that the breeding-season had passed. The two ornithologists referred to above report only immature birds at Clipperton in November.

The specimens in the Academy's series agree very well with the descriptions[2] of the adult and immature males given by Messrs. Snodgrass and Heller. There seem to be no characters, aside from length of culmen, which differentiate the males and females, either adult or immature. All of the young birds taken were able to fly, and all were captured at Cocos Island, with the exception of one secured on Clipperton, August 10.

Of a series of thirty specimens taken on Clipperton on August 10, one (No. 1593 C. A. S.) is completing the juvenal plumage, for the primaries and rectrices are yet in an immature state. Growing feathers are also to be seen in both the dorsal and ventral tracts. Two specimens, Nos. 1525 and 1548, are immature, and are going through a belated first

[1] Proc. Wash. Acad. Sci., v. 4, p. 510.
[2] *Ibid*, p. 509.

prenuptial moult, or else through the first postnuptial moult. The moult involves the entire plumage in both cases. It is to be noted that, in No. 1525, the two lateral and several of the median rectrices have been renewed, while in No. 1548, the renewal seems to be starting with the median rectrices. The remaining twenty-seven specimens are to all appearances adults in worn nuptial plumage. Nearly all are entering upon the postnuptial moult, as attested by pin-feathers in the back and breast and, in a few cases, by new inner primaries and new rectrices. No. 1523 exhibits a pure white feather at the base of the hind neck; aside from this, no trace of albinism was noted in the species.

Twenty-three Cocos Island adults are in a state somewhat similar to that of the Clipperton Island specimens, the breeding-season on the latter island evidently being later. In some cases the moult of the body-plumage, particularly anteriorly, seems to be farther advanced. Four immature specimens from Cocos Island, Nos. 1528, 1573, 1591, and 1592, seem to be comparable to Nos. 1525 and 1548 from Clipperton. It is presumed that the moult in this case is the first postnuptial. One specimen, No. 1528, seems to have recently acquired new primaries; in fact, the distal primary in each wing is just appearing from its sheath. Thirty-four Cocos specimens are in the juvenal plumage, and give no evidence of postjuvenal moult except an occasional pin-feather in the crown and back of several. September 13 is the latest date on which specimens were taken.

Certain adults show to some extent the character ascribed by Messrs. Snodgrass and Heller to *Micranous hawaiiensis* in the following sentence: "In *M. hawaiiensis* the pale slaty plumbeous color of the back of the head and neck reaches so far ventrally on the sides of the head and neck, and even on the upper part of the breast, that there is distinctly marked off on the chin and throat a median longitudinal area of dark plumbeous-brown well defined on each side against the paler lateral parts."[1]

The Academy's series of the Clipperton Noddy numbers ninety-three specimens, twenty-six of which are adult males, and thirty adult females. The adult males average in milli-

[1]Proc. Wash. Acad. Sci., v. 4, p. 510.

meters as follows: Wing 232; tail 124; culmen 44.7; depth of bill at base 9; tarsus 20.2; middle toe 27.8. The adult females average as follows: Wing 229; tail 121; culmen 42.2; depth of bill at base 8.4; tarsus 19.7; middle toe 27.5.

Four adult males and two adult females from Clipperton measured in millimeters in the flesh as follows: Males—Lengths 345, 355, 357, 370; extents 675, 677, 685, 700. Females—Lengths 353, 358; extents 672, 680.

Table V., p. 113, gives separately measurements of birds of both sexes from Cocos and Clipperton islands.

Seven eggs collected on Clipperton Island are elliptical-ovate and elongate-ovate in shape, and in color and style of markings resemble the eggs of the common Noddy. They measure in millimeters as follows: 44.8×31.5, 47.3×32.7, 43.7×32, 44.6×31.5, 46×30.8, 45.2×32.5, 45.6×30.8.

### Gygis alba: WHITE TERN

Tower Island.

A White Tern passed close to the vessel on September 14, 1906, when off Tower Island. Another was captured by Mr. Beck on Oneal Rock, near Socorro, Revilla Gigedo Islands, on July 27, 1905. It was the only one observed among thousands of Sooty Terns and Noddies.

On August 9, 1905, the second specimen for the expedition was seen near Clipperton Island, Mexico. The following day, on that island, a dozen were found, in company with Brewster's Boobies, roosting on the crossbeams of a shed, one end of which had an opening, giving the birds access.

During the voyage from Clipperton Island to Cocos Island, Costa Rica, White Terns were noted as follows:

August 29, 1905, latitude 5° 22′ North, longitude 87° 5′ West—two.

August 31, 1905, latitude 4° 5′ North, longitude 88° 3′ West—a few.

September 2, 1905; forty miles south of Cocos Island—two or three.

At Cocos Island they were commonest in the forests, roosting in the trees both inland and along the coast. They were seen also among the trees on the small outlying Nuez Island.

The forests on Cocos Island are very luxuriant, and the island is well watered, streams flowing down on all sides. It is in this setting that the terns appear to greatest advantage. As a rule, the first intimation a person gets of their presence is a startling clucking over his head. Upon looking up he will find two or three of these beautiful inhabitants of the forest hovering within a yard of his head. After flying about him four or five times, they will dart away among the trees with a flight as sure as that of any woodland bird.

Over the water their flight was very swift and erratic, and usually at a considerable elevation. None were seen on the water. They paid but little attention to a boat, seldom approaching to examine it. At times they were seen in pursuit of each other, and then their evolutions were the swiftest. One day eight or ten were seen pursuing an Osprey.

Mr. A. F. Basset Hull, in *The Proceedings of the Linnean Society of New South Wales,*[1] takes exception to the remarks of Messrs. Snodgrass and Heller[2] on the method of nesting of this species at Cocos Island.

A young female (No. 1617 C. A. S.) in juvenal plumage, was obtained at Clipperton. The scapulars, interscapulars, and tertials are strongly washed with russet. The lesser coverts, some of the feathers of the crown and of the sides of the breast, and the two middle rectrices are edged with russet terminally. The forehead has a faint tinge of the same color. A few tufts of grayish down still adhere to some of the feathers of the top of the head. The shafts of the primaries are olive brown. Three outer rectrices on each side of the tail have pure white shafts, and the remaining rectrices have shafts that are white for the greater part of their length, being olive brown only subterminally. In length of wing and of tarsus this specimen exceeds the average of ten adult females given beyond. It measures in millimeters as follows: Wing 250; tail 115; culmen 33.5; tarsus 13; middle toe 21.

In the Academy's series of twenty adults, dark-shafted rectrices are a marked feature. With a few exceptions, the specimens are in somewhat abraded plumage. No. 1604, male, Oneal Rock, July 27, seems to be in fresh feather; occasional pin-feathers in the crown, back, and rump, are appar-

[1] V. 34, p. 662, footnote.
[2] Proc. Wash. Acad. Sci., v. 4, p. 511.

ently bringing the moult to a close. Nine Clipperton skins, August 10, are passing through what I take to be the post-nuptial moult. In some cases it seems to be almost completed, and, with the exception of No. 1619, it has reached the remiges in every case. Renewal of rectrices seems to proceed from the center laterally, renewal of primaries from the proximal to the distal, and renewal of secondaries apparently from the distal to the proximal. There are exceptions to these rules, certain feathers coming in out of turn. Ten Cocos specimens, taken during the first half of September, are in a similar state, but, if anything, are not quite so far advanced as the Clipperton specimens.

The bill of the adult bird in life is black at the tip, shading through purple to indigo blue at the base.

MEASUREMENTS (in millimeters)

| No. | Sex. | Locality | Wing | Tail | Culmen | Tarsus | Middle Toe |
|---|---|---|---|---|---|---|---|
| 1604 | ♂ | Oneal Rock | 240 | 115 | 37.4 | 12.9 | 20.4 |
| 1619 | ♂ | Clipperton | 223 | 110 | 38 | 12.1 | 21.3 |
| 1620 | ♂ | Clipperton | 252 | 122 | 38.6 | 12.7 | 21.8 |
| 1621 | ♂ | Clipperton | 234 | 120 | 41 | 12.7 | 22.5 |
| 1624 | ♂ | Cocos | 240 | 119 | 38.6 | 11.9 | 22 |
| 1623 | ♂ | Cocos | 251 | 118 | 43 | 12.5 | 21.2 |
| 1607 | ♂ | Cocos | 248 | 112 | 41.8 | 12.1 | 22 |
| 1606 | ♂ | Cocos | 239 | 120 | 41 | 13.2 | 22.1 |
| 1605 | ♂ | Cocos | 248 | 111 | 40.5 | 12.6 | 21.6 |
| 1608 | ♂ | Cocos | 260 | 119 | 42.2 | 12.4 | 22.2 |
| 1613 | ♀ | Clipperton | 241 | 122 | 41 | 12.8 | 22 |
| 1622 | ♀ | Clipperton | 231 | 129 | 39 | 12 | 22 |
| 1612 | ♀ | Clipperton | 236 | | 37 | 11.6 | 21 |
| 1615 | ♀ | Clipperton | 235 | 107 | 36.7 | 12.5 | 21.2 |
| 1616 | ♀ | Clipperton | 240 | 118 | 40.8 | 12 | 22 |
| 1618 | ♀ | Clipperton | 237 | 111 | 38.3 | 12.2 | 21.4 |
| 1614 | ♀ | Cocos | 254 | 124 | 40 | 12.8 | 21.9 |
| 1611 | ♀ | Cocos | 237 | 116 | 39 | 11.7 | 21.2 |
| 1610 | ♀ | Cocos | 251 | 126 | 41.6 | 11.1 | 22 |
| 1609 | ♀ | 40 miles south of Cocos | 245 | 122 | 38.9 | 12.1 | 22.4 |

The following is a summary of the above measurements: Males—Wing 223–260 (244); tail 110–122 (117); culmen 37.4–43 (40.2); tarsus 11.9–13.2 (12.5); middle toe 20.4–22.5 (21.7). Females—Wing 231–254 (241); tail 107–129 (119); culmen 36.7–41.6 (39.2); tarsus 11.1–12.8 (12); middle toe 21–22.4 (21.7).

### Creagrus furcatus: SWALLOW-TAILED GULL

Albemarle, Brattle, Champion, Charles, Chatham, Cowley, Crossman, Culpepper, Dalrymple, Daphne, Delano, Enderby, Gordon, Guy Fawkes, Hood, Indefatigable, islet off northeast James, James, Kicker, Narborough, Seymour, Tower, and Wenman islands.

This fine gull has been observed in the archipelago during every month of the year, and is found commonly about the small tufaceous islands and some of the high sea-cliffs of the large islands. None were observed about Elizabeth Bay, Tagus Cove, or Banks Bay, Albemarle Island, nor on east and north Narborough in March and April. It is a bird of powerful flight, often being seen many miles from land. The farthest south it was observed was about 160 miles southwest of Albemarle on June 9, 1906, and the farthest east was about 150 miles east of Chatham on September 22, 1905. No examples were met with north of the islands.

The single egg was usually laid in a slight depression lined with bits of stone. When disturbed the gulls generally flew off, leaving their eggs and young to the mercy of the intruder. In one case, however, a parent remained on the nest and allowed itself to be petted, not offering to bite. In many instances, when a bird was caught, its main effort was to escape rather than to defend itself. The young generally snapped their bills threateningly when molested.

The Swallow-tailed Gull is known to nest in the Galapagos Islands during eight months[1] of the year, as follows: On Brattle in October; on Culpepper in July;[2] on Hood in January, February, June, July, and October;[3] on Tower in September and December;[4] and on Wenman in July,[5] August,[6] and December.[7] The Academy's series of eggs was taken on Hood in February and June, and on Tower in September.

The eggs observed on Tower Island in the middle of September, 1906, were quite fresh, although a newly-hatched

[1] On page 190, volume 6, of Novitates Zoologicae, Messrs. Rothschild and Hartert state that this species was "found breeding * * * in October on Tower, and in December on Hood Island." This is undoubtedly a mistake, as the Webster-Harris Expedition visited Tower in December and Hood in October. See pp. 99, 103, 124, 135.

[2] Nov. Zool., v. 6, p. 190.

[3] *Ibid.*, pp. 99, 127.

[4] *Ibid.*, pp. 104, 135.

[5] *Ibid.*, v. 6, p. 190; v. 9, pp. 412, 413.

[6] *Ibid.*, v. 6, p. 90.

[7] Proc. Wash. Acad. Sci., v. 5, p. 238.

chick was also seen. A number of young birds in the down were encountered at Hood Island in February, all running about in a lively manner. Two or three young just able to fly were also noted walking about in hunched-up attitudes among the adults, and apparently begging for food.

As a rule these gulls could be approached fairly closely. After two visits to the islet off northeast James, however, the birds of that place became quite wary, often flying before the boat arrived within shot-gun range. As a rule this gull is not lured to a decoy; but exceptions were observed south of the archipelago, when two approached, one to examine a wounded Dark-rumped Petrel, the other a wounded Peruvian Booby.

Their enemies on land seemed to be the Galapagos Hawks. Two young birds on Hood Island, which were tied up and left for a short time, were killed and torn to pieces by one of these birds. The Man-o'-war Birds often pursued the adult gulls to make them disgorge, and the evolutions gone through by both species were very surprising, the victim dashing about in all directions. One poor gull was observed with two of its enemies in pursuit. It did not disgorge, and as a result one of the pirates seized its foot, injuring it so that it hung down, after which the tormentors desisted.

When flying, birds of this species seemed to have alternate upward and downward movements of the body with each stroke of the wings. Usually they flew singly or in flocks not exceeding half a dozen. On northeast Indefatigable some were seen circling high in the air without any discernible movement of the wings. They never circled about the vessel except at sea. Birds were seen resting on the water in only two instances, once at Daphne and once at sea. In the latter case a bird, which was flying close to the water, alighted. Three others very high in the air then came swooping down in long spirals, as Man-o'-war Birds do, and sat on the water with the first bird. Whether or not they were feeding, could not be ascertained.

I have never for a certainty observed them feeding, and rather suspect that as a rule they do so at night. Their diet seems to consist chiefly of squids, which both young and old often disgorge when being killed. At Daphne five or six

were seen hovering over a school of fish. Two birds taken in latitude 2° 29′ South, longitude 90° 4′ West, had each a specimen of water-strider of the family Hydrometridæ in its stomach; otherwise, save for wing-discs of pteropods, their stomachs were empty.

On the cliffs of northeastern Indefatigable Island in November, and on Daphne in November and July, only adult gulls were seen. The same remark applies to Tower Island in the middle of September, 1906, save for one very young chick.

In their descriptions of this species, both Mr. Ridgway[1] and Mr. Saunders[2] fail to mention a pinkish blush on the white of the under parts. This is quite marked in a number of fine fresh-plumaged Academy specimens of both sexes, taken about the first of August from the islet off northeast James. All the birds captured at that place at that time had enlarged reproductive organs, although some did not have the pinkish blush. It was not noted to any extent in specimens taken elsewhere.

This gull differs from *Xema sabinii* and other small hooded gulls in its moult. The dark hood is apparently kept the year around after the bird attains maturity. Nothing in the Academy's series would indicate the contrary, and the subjoined notes on this series seem to show that such is the case. The study of moults and plumages in this species is complicated by the fact that it has been found breeding on various islands during eight months of the year.

Two specimens taken on Hood Island in latter September, 1905, are in fresh plumage. Scattered pin-feathers are yet to be found in the white under parts and in the interscapular region. In one specimen the distal primary of each wing is still in the sheath basally. As this gull nests on Hood both in June and October, the question is whether this moult, which is just closing, is postnuptial or prenuptial. I am inclined to believe it is the latter.

Two specimens from Brattle Island, male and female, October 30, are in fairly fresh plumage. No feather-growth is indicated, however, and the feathers of the mantle show slight wear in places. At the time of our visit to Brattle

[1]Proc. U. S. N. M., v. 19, p. 638.
[2]Cat. Birds Brit. Mus., v. 25, p. 166.

Island, the birds were nesting, and an incubated egg was obtained. These specimens may be safely said to exemplify the breeding-plumage of the species.

The examination of twenty-one adults from Daphne Island and northern Indefatigable, latter November, proves that the birds are in fresh plumage. Feather-growth is attested in many by the presence of pin-feathers in the back and the breast, and by the sheaths at the base of the distal primaries. Evidently the rectrices in this species are entirely renewed before the distal primary is fully grown. The question of whether the moult just being completed is postnuptial or prenuptial again comes to the front. The only light on the nesting of this gull on Daphne is as follows: "Mr. Beck found it very common on Daphne Island, where it was preparing for nesting by the end of March."[1]

Twenty-two adults taken on Hood Island in early February, when nesting operations were at their height, for the most part show more or less wear. In a few cases pin-feathers are appearing in the interscapular region, but they are appearing more commonly in the white under parts. These pin-feathers evidently indicate the beginning of the postnuptial moult.

Of a pair of birds, taken at sea on April 24 off southwest Albemarle, the male is in worn adult plumage, and exhibits no new feathers. The female, No. 1675, is apparently an immature bird coming into its first adult plumage. Whether the moult is prenuptial or postnuptial is impossible to say. The feet are much paler than those of full adults. The tail is pure white and the outer rectrices quite worn. The primaries also show wear. Several white feathers in the sides of the head are hidden by the dark ones, while numerous dark feathers are appearing from their sheaths. This individual is evidently in a stage somewhat similar to that shown by No. 1721, mentioned below.

A female with small breeding-organs, taken at sea on May 8, is in rather worn plumage, and shows new dark feathers replacing the old ones of the crown.

Three adults with enlarged reproductive organs were taken at Hood Island about the first of July, the opening of a nest-

[1]Rothschild and Hartert, Nov. Zool., v. 9. p. 412.

ing season. One specimen was in slightly worn plumage dorsally, with pin-feathers still appearing in the breast; another was in fresh plumage, apparently with no growing feathers; the third, No. 1628, was in fresh plumage, with pin-feathers in the white lower parts and the remains of a sheath at the base of each distal primary. Now as these specimens are, in all likelihood, in nuptial plumage, the presence of a sheath at the base of a distal primary, in connection with the freshness of all the primaries, would seem to indicate a prenuptial moult of the flight-feathers as in the terns. Nothing in the entire series contradicts this assumption, but, nevertheless, I do not feel that I have enough light on the subject to assert positively that such is the case.

Thirty-three adults with enlarged sexual organs, from an islet off the northeast coast of James Island, were taken late in July and early in August. All are in fresh or slightly worn plumage (primaries included) and exhibit but little or no feather-growth. In these as well as in all other adults examined, some of the tertials and longer scapulars are worn, and not in harmony with the rest of the plumage. This is undoubtedly due to two causes; first, that some of the feathers are hold-overs, and second, that they are more subject to wear than other parts of the plumage.

Of three specimens from Cowley Island, August 13, two are quite fresh and show no pin-feathers. The third is somewhat worn, and has pin-feathers appearing in the back and in the white under parts.

A female from Culpepper Island, September 25, 1906, is in full fresh plumage, except for a much abraded long scapular and somewhat ragged outer rectrices. No pin-feathers or other indication of feather-growth are to be found. As this species breeds on Culpepper in July, this specimen is probably in postbreeding plumage.

A female (No. 1721 C. A. S.) taken at sea on May 8 is adult in every particular, save that the hood is mottled with pure white feathers, and the naked parts in life were paler than they are in the average adult. Numerous new dark feathers are appearing on the head to replace the worn white ones. A few pin-feathers are also to be found in the back and breast. The primaries and rectrices are slightly worn

and are not those of the juvenal plumage, but are similar to those of adults. The assertion might be ventured that this specimen is assuming the first nuptial plumage. A few worn feathers in the mantle, similar to those of adults, are of no significance, since a few such feathers are common in birds in juvenal plumage.

Quite a few white-headed young similar to the one described[1] by Mr. Saunders from Paracas Bay, Peru, were seen at sea in May and June, and at Hood Island in February, June, and September. Some have brownish tips to the crown-feathers, but these disappear as the birds grow older, the crown becoming pure white. The pale tips of the feathers of the back wear off to some extent with increasing age, giving the upper parts a much duskier appearance. There are gray feathers in the backs of young birds in juvenal plumage, foreshadowing the beautiful mantle of the adult stage. As remarked by Mr. Saunders[1] the primaries of the young are like those of the adult in markings, even in the very youngest in which they are developed enough for examination. They seem, however, to be more pointed and less rounded terminally than those of the adult. Five June specimens fom Hood Island are in juvenal plumage, more or less worn, but showing no evidences of moult. The same remarks apply to a male taken on Hood on September 28, 1905. Mr. Beck gives the following colors for the naked parts of a young female just fully fledged: Bill blackish; feet grayish white.

In a downy young one (No. 1658 C. A. S.) taken on Hood Island on February 6, the scapulars are just appearing, being fawn-color with dark brown bases. The down of the upper parts is brownish gray. Below it is chiefly white, shading to pale gray on the throat and chin. Much of the white down on the anterior part of the body has grayish hair-like tips. On the posterior portion of the body the down seems to be in two sections. The upper section in some cases is gray, and the lower white. The gray grows from the tip of the white, and at the junction of the two the filaments are gathered into a single, slender, compact stem.

An examination of young *Larus occidentalis* at approximately the same age as the downy *Creagrus furcatus* was

[1]Cat. Birds Brit. Mus., v. 25, p. 166.

fruitless as far as finding another case of double down was concerned; nor did the examination of the downy young of other Lariformes (*Hydrochelidon nigra, Sterna forsteri, Sterna antillarum, Sterna fuliginosa,* and *Anous stolidus*) develop another instance. Dr. Dwight makes no mention of such a condition in any of the Lariformes examined by him in the preparation of his paper on *The Sequence of Moults and Plumages of the Laridæ* (*Gulls and Terns*).[1]

In the following table are given measurements of eleven young gulls (in downy and juvenal plumages) taken from the colony on southeastern Hood during the first week of February, 1906.

MEASUREMENTS (in millimeters)

| Number | 1658 | 1640 | 1684 | 1652 | 1695 | 1642 | 1732 | 1726 | 1731 | 1729 | 1728 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Sex | ♀ | ♂ | ♂ | ♀ | ♀ | ♀ | ♂ | ♀ | ♀ | ♀ | ♂ |
| Culmen | 28 | 29.7 | 31.3 | 38.5 | 39.2 | 40.5 | 41.8 | 42.5 | 43.9 | 44 | 47.2 |
| Tarsus | 30.3 | 31.3 | 34.5 | 48.2 | 45.7 | 46.3 | 51.1 | 48 | 48 | 47.2 | 49.5 |
| Middle Toe | 32.4 | 34 | 36.1 | 44 | 44 | 45 | 46.7 | 43 | 45 | 46.9 | 47 |

The colors of the naked parts of the adults in life were as follows: Bill black, tip gray pea-green; rictus crimson; skin in interramal space salmon-colored; orbital ring crimson; iris dark brown; tarsus and toes peach-blossom pink; webs geranium pink shaded with black at edges.

Forty-three adult males measure in millimeters as follows: Wing 410–442 (424); tail 181–216 (196); culmen 50–55.5 (52.8); tarsus 45–56.5 (50.2); middle toe 44–51.3 (47.5).

Forty-seven adult females measure in millimeters as follows: Wing 406–432 (417); tail 181–210 (192); culmen 48.4–53.9 (51); tarsus 44.3–51.9 (48.1); middle toe 43–49.4 (45.8).

Five males in the flesh yielded the following measurements in millimeters: Lengths 571, 580, 590, 591, 606; extents 1362, 1375, 1382, 1390, 1392. Three females gave the following results: Lengths 550, 560, 573; extents 1241, 1318, 1330.

[1]Auk, v. 18, pp. 49-63.

The remarks[1] by Messrs. Rothschild and Hartert as to the markings and shape of the eggs of this species apply admirably to the Academy's series of thirty-six eggs. The extreme and average measurements of this series are summarized as follows: Length 62.1–72.5 mm. (66.3 mm.); breadth 44–47.6 mm. (45.9 mm.).

### Larus franklini: FRANKLIN'S GULL

Albemarle, Chatham, and Narborough islands.

Three specimens of this gull have been taken in the islands; the first by Messrs. Snodgrass and Heller[2] at Mangrove Point, Narborough Island, in March; the second by Mr. Hunter at Sappho Cove, Chatham Island, on February 10, 1906; and the third by Mr. Hunter at Villamil, Albemarle Island, on March 6, 1906.

Both the Albemarle and the Chatham specimens were in worn plumage. The former was an immature male, infested with mallophaga, and the latter an immature female. Compared with the Sooty Gull, they were quite wild.

### Larus fuliginosus: SOOTY GULL

Abingdon, Albemarle, Barrington, Bindloe, Brattle, Champion, Charles, Chatham, Cowley, Crossman, Daphne, Duncan, Hood, Indefatigable, islet off northeast James, Jervis, Narborough, Seymour, and Tower islands.

Unlike the Swallow-tailed Gull, the Sooty Gull is not a bird of the sea-cliffs and ocean, but instead is found commonly about the shores and lagoons of many of the islands. Although taken at Hood Island by other expeditions, we did not meet with it there during any of our three visits. At Barrington, Brattle, Cowley, Crossman, Daphne, Duncan, and Jervis islands it was not common. Evidently birds fly from island to island, as their occurrence at places where they do not seem to be resident would show. On August 13, while we were en route from Cowley Island to Duncan, two or three were seen several miles from land.

More than once during the breeding season a pair of gulls would swoop several times at a human intruder in an evident

[1] Nov. Zool., v. 6, p. 190.
[2] Proc. Wash. Acad. Sci., v. 5, 237.

attempt to frighten him away from a nest near by, which, however, was never discovered. The only egg known was taken by the Webster-Harris Expedition on November 10, 1897,[1] from a bird shot on Albemarle Island.

Sexual organs of birds taken in October and November were large, while some adult birds taken off south Albemarle about the 1st of May were in fresh plumage and had large sexual organs. Mr. Beck wrote on the label of a male from Seymour, taken July 25, "testes large."

Wherever they were at all common, they came about the vessel, usually circling many times and often alighting on the water or on the booms, railings, etc., of the vessel, being fully as bold as the Glaucous-winged Gulls (*Larus glaucescens*) about San Francisco Bay, California.

The flight of this species is similar to that of other gulls of the same genus. They can walk and run quite swiftly, and, when rising from the ground, usually run three or four feet and rise against the wind. Like most other gulls they are readily attracted to wounded or dead birds.

The Sooty Gull is certainly a scavenger of the first order. Whenever tortoises or turtles were skinned on board the schooner, several gulls would loiter about picking up refuse. At Villamil, Albemarle Island, it was a common sight to see them feeding with the chickens about the village and under the houses, which in most cases were placed on timbers several feet above the ground. On the beach west of Villamil, forty or fifty gulls were one day observed feeding on the putrid remains of a turtle.

The following notes were made at Villamil on August 20: There were a dozen gulls feeding near a house where a bull had been slaughtered. Some were tugging away at bits of fat and flesh, often bracing themselves with their feet. Others were feeding on a fresh hide that had just been staked out to dry. Two or three adults were bullying the younger birds. Whenever an adult desired a piece of meat on which one of the younger ones was pulling, he would lower his head, arch his neck, and give a long cackling call, at the same time making a short rush at the enemy. The young birds always got out of the way when such tactics were pursued. There was one

[1]Nov. Zool., v. 6, p. 189; v. 9, p. 413.

immature bird imitating the calls of the adults, its voice, however, being harsher. Both young and adults had a wholesome respect for dogs and chickens. They would allow a man to approach within four or five feet of them before flying or running.

At Wreck Bay, Chatham Island, about three weeks later, I saw three adults chasing other adults about and making the same long cackling calls, always standing very erect for a moment before giving the call. In this case their actions may have been a form of courtship.

This species calls throughout the year, uttering a short squawk as well as the long cackling call, which latter can best be described as beginning with a chuckle and then breaking into a cackling laugh.

Not infrequently this species was seen in company with various other birds. Of such association the three following instances are good examples: 1. One day in early March there were a good many paddling about and calling in one of the lagoons near Villamil. Intermingled with them were Egrets, Galapagos Herons, Bahama Pintails, and Black-necked Stilts. 2. At southeast Narborough this species was noticed in company with Blue-footed Boobies, Flightless Cormorants, Brown Pelicans, and Galapagos Herons, on a small islet about ten by thirty feet in dimensions. 3. On a rocky point on the northeast side of James Island a gull was seen standing in the midst of a compact flock of Blue-footed Boobies.

Their competitors on the water seemed to be chiefly the Graceful Petrel and the Man-o'-war Bird. These two species were usually present whenever there was any refuse about. Other petrels of the Dusky Shearwater also entered in a lesser degree into the competition. About the settlements, chickens, dogs, cats, and pigs were their chief rivals.

The feet of individuals of this species seem to be subject to a good many accidents, for specimens with split webs were frequent and those with deformed toes occasional.

The plumages of this species have been so thoroughly described by previous writers that there is little to add, so far as the Academy's series is concerned. The white streak on each eyelid, which characterizes the adults, is represented in

the young birds by a faint gray streak, which gradually whitens with successive moults.

In the manner and extent of its moults and plumages this species seems to accord strictly with *Larus heermanni* and the other larger gulls treated of by Dr. Dwight in his paper on *The Sequence of Moults and Plumages of the Laridæ (Gulls and Terns)*.[1] The study of the moults and plumages is of course complicated by the lack of definite data concerning the breeding of the species. It is very evident from the Academy's series that there is great latitude in the time at which different individuals start on a stated moult. Birds taken on the same day and in the same locality sometimes differ widely in their state of plumage. Further indication of an extended breeding season is found in two birds in juvenal plumage, one taken on south Albemarle on November 1, the other taken on Chatham on July 7. A pair of adults taken on Charles Island, October 5, were evidently nesting, judging from the bare skin in two places beneath the feathers of the abdominal region. The absence of growing feathers shows that the postnuptial moult had not commenced. The adults of this species do not lose the dark hood at the postnuptial moult as do the smaller hooded gulls, but on the contrary replace it with another.

The following examples of albinism were noted in handling the Academy's series: No. 1759; nearly adult male; white feather in foreneck. No. 1735; adult male; conspicuous white streak in one web of scapular on right side. No. 1770; adult male; white feather in crown.

Colors of naked parts in life were noted as follows: 1. High-plumaged adult—Bill dark bay shading into black near tip; tip of maxilla burnt sienna; feet dark prune purple, with webs bay beneath and toes rufous beneath; orbital ring dark crimson. 2. Nearly adult female (No. 1793 C. A. S.) with some dark markings in the tail—Bill and feet black; tip of maxilla burnt sienna. 3. Immature—Bill, orbital ring, and feet black; under sides of webs gray.

The following condensed measurements in millimeters are taken from forty-nine males and fifty-five females. There seems to be no appreciable difference in the dimensions of

[1] Auk, v. 18, pp. 49-63.

adult and immature birds. Two females measured respectively in the flesh 445 and 450 millimeters in length, and 1075 and 1095 in extent.

Males—Wing 343–373 (357); tail 133–154 (145); culmen 40.5–47 (43.9); tarsus 47–54.8 (51.7); middle toe 38.5–45 (42). Females—Wing 330–358 (344); tail 130–147 (138); culmen 37.5–45 (41.4); tarsus 45.3–53.5 (49.9); middle toe 36.5–44.3 (40.3).

### Stercorarius pomatorhinus: POMARINE JAEGER

Albemarle Island.

Mr. Beck shot a female Pomarine Jaeger off northern Albemarle Island[1] on December 15, 1897.

North of the Galapagos Islands this jaeger was occasionally met with, three being taken by Mr. Beck during the homeward voyage. Two females were captured on October 5 in latitude 14° 28′ North, longitude 107° West. A young male (No. 1849 C. A. S.), taken on November 14 in latitude 33° 7′ North, longitude 134° 6′ West, had the naked parts in life as follows: Iris dark brown; orbital ring black; nasal shield gray; bill broadly tipped with very dark brown; lower mandible lavender-gray, except distal portion; tarsi very pale blue; webs and toes almost entirely black, save at junction with tarsi.

Two Parasitic Jaegers (*Stercorarius crepidatus*) were taken at sea—one about thirty miles west of San Martin Island, Baja California, on July 10, 1905, and another in latitude 15° 36′ North, longitude 110° 12′ West, on October 13, 1906. On September 30, 1906, in latitude 10° North, longitude 100° 25′ West, one followed the schooner for several minutes.

### Arenaria interpres: TURNSTONE

Abingdon, Albemarle, Barrington, Bindloe, Brattle, Charles, Chatham, Culpepper, Daphne, Gardner-near-Hood, Hood, Indefatigable, James, Jervis, Narborough, Seymour, Tower, and Wenman islands.

Although nowhere found breeding, this species was observed by us on all of the above islands and in every month of the year. It proved to be the commonest shore-bird of the

[1]Nov. Zool., v. 6, p. 192.

archipelago, and was found in the uplands as well as along the seashore. Between May 28 and June 23, however, but one individual was seen, and that was at Charles Island on June 1.

A few were seen at Wafer Bay, Cocos Island, Costa Rica, on September 4 and 13, 1905.

Of several individuals killed at Tagus Cove, March 29, some were in high plumage, while the majority were in transition. The sexual organs, however, showed only slight enlargement. A male, taken on southeastern Albemarle on May 1, was in high feather. Specimens captured on Hood Island, on June 23, had small reproductive organs, as did three or four obtained at Academy Bay, Indefatigable Island, on July 14.

**Hæmatopus galapagensis**: Frazar's Oyster-catcher

*Hæmatopus frazari* Brewster, Auk, v, 1888, 84 (Carmen Island, Gulf of California).

Albemarle, Barrington, Bindloe, Charles, Chatham, Gardner-near-Hood, Hood, Indefatigable, James, Narborough, Seymour, and Tower islands, Delano Rock, and islets east of Jervis Island.

As suggested[1] by Mr. Ridgway, *Hæmatopus galapagensis* and *Hæmatopus frazari* are undoubtedly one and the same species. Mr. Ridgway "reduces the alleged color differences between that bird [*Hæmatopus galapagensis*] and the Lower Californian form described as *H. frazari* by Mr. Brewster to two, namely, the smaller amount of dark color on the under surface of the wing and the partially spotted or barred under tail-coverts of the latter."[2]

A thorough examination of the Academy's material, twenty specimens from Baja California and forty-four from the Galapagos Islands, demonstrates that the "greater amount of white on the under primary coverts" of the so-called *Hæmatopus frazari* is an absolutely worthless character, as the series from both regions show an almost equal range of variation in respect to the coloration of these coverts. Twelve of the forty-four Galapagos specimens exhibit partial dark edgings on certain of the under tail-coverts; all, however, to a much

[1] Proc. U. S. N. M., v. 19, p. 623.
[2] *Ibid.*, p. 624.

less degree than shown by the average Baja California specimens. One female (No. 1941 C. A. S.) from the latter region, has no dark edgings on the under tail-coverts—a condition perhaps due to wear.

As shown by the measurements of Table VI, p. 114, there are but slight differences between average specimens from the two localities. The Galapagos birds average larger in length of culmen and length of middle toe, while the Baja California birds average larger in length of wing and length of tail. The measurements of the two series, however, overlap, and in the absence of constant color characters, it is impossible to find in the slight differences in the average measurements any basis for specific distinction.

Three young males from the Galapagos Islands (Nos. 1893, 1902, and 1930 C. A. S.) have down adhering to some of the juvenal feathers, considerable gray down on the throat, and primaries not full grown. Many of the scapulars, interscapulars, tertials, and wing-coverts are marked terminally with a narrow light-brown edge, and subterminally with a narrow dark-brown or black bar. The tarsi are very much swollen near the suffrago. This swelling, however, disappears as the birds grow older. In dried skins the young have the naked parts of a much darker color than the adults.

In two older specimens (Nos. 1891 and 1892) still showing traces of down on the rectrices, the brown edgings are yet present on the wings, but have disappeared from the back, having evidently been removed by wear. New feathers are appearing in the back, head, neck, and breast of these two specimens. The new feathers have no brown margins, but appear indistinguishable from those of adults. Inasmuch as the birds still show traces of neossoptiles, it is assumed that this moult is postjuvenal and not prenuptial.

The measurements of the five young birds are given below.

MEASUREMENTS OF YOUNG BIRDS (in millimeters)

| Number | Sex | Island | Date | Culmen | Tarsus | Middle Toe |
|---|---|---|---|---|---|---|
| 1930 | ♂ | Hood | February 1 | 52 | 46.8 | 36 |
| 1902 | ♂ | Hood | February 1 | 59.8 | 50.8 | 39.6 |
| 1893 | ♂ | Narborough | March 22 | 63.1 | 50.7 | 36.5 |
| 1891 | ♀ | Seymour | July 26 | 80 | 49 | 37.5 |
| 1892 | ♀ | James | August 4 | 76 | 48.1 | 38.2 |

No. 1913, female, Hood Island, September 28, 1905, is evidently a young bird starting on its first prenuptial moult. The primaries are old and worn, and some feathers much bleached and worn remain among the lesser coverts. In addition to the dusky bill and feet, this bird has a sharp line of demarcation between the black and the white on the upper breast.

No. 1909, male, Indefatigable Island, July 16, is in fresh plumage. The distal primary in each wing, however, is not full grown, but is pulpy at the base. The feet are dusky compared with those of adults, and it is probable that the specimen is a young bird going through either its first prenuptial or first postnuptial moult. Again the line of demarcation of the black and white on the breast is sharp, while in adults such is not the rule.

No. 1888, male, Abingdon Island, September 18, 1906, is in about the same state as the specimen just discussed, or perhaps a little younger. The line of demarcation on the upper breast is sharp, and the naked parts are dusky. It is difficult to say whether this bird is completing its first prenuptial or its first postnuptial moult.

The following notes are on obvious adults: Five specimens taken on Hood Island and Gardner-near-Hood in latter September, 1905, are all in moult, and have primaries in some stage of growth. As the sexual organs of these birds showed signs of activity, and as we obtained young on the first of the following February, it seems as though the moult in progress is the prenuptial, and that this species moults its flight-feathers twice a year.

Four specimens from Indefatigable Island, secured during the second half of October, are moulting. One has worn primaries, another has new full-grown primaries, while the remaining two have the distal primaries still pulpy basally. Three November individuals, however, are in fresh plumage, the primaries just having attained full growth. In two cases traces of a sheath are discernible at the base of the distal primary.

The next specimen in order of capture is a male taken on James Island on December 26. Except for somewhat worn primaries, this bird is in fairly fresh plumage, and has a con-

siderable number of pin-feathers in the body plumage. It is perhaps completing its prenuptial moult, or possibly starting on its postnuptial.

Four January birds, three from Indefatigable Island and one from Hood, are in all likelihood beginning the postnuptial moult. All show pin-feathers and newly-expanded feathers in the body, and one shows new inner rectrices.

Two specimens from Hood Island and three from Chatham were taken during February. All show a moult in progress, and in one case the primaries have been renewed in part. Undoubtedly these birds were engaged in the postnuptial moult. The sexual organs of two of the specimens, obtained on February 14, were noted as small.

In addition to the young one shot on Narborough Island on March 22, a female (No. 1914) in worn plumage was secured. This bird showed the renewal of the body-plumage to be taking place. It was in practically the same state as the two adults taken on Hood Island on February 1, while the young one was of about the same age as the two young taken on Hood on February 1. This would seem to indicate a later breeding-season on Narborough than on Hood, or at least an extended breeding-season. No. 1925, Tagus Cove, Albemarle Island, March 29, is in the same stage as No. 1914.

A gap of nearly four months occurs in the dates of the series, the next specimens being five July adults from Indefatigable and Seymour islands. All show pin-feathers. Three are in fresh plumage: one with full-grown primaries, one with the distal primary growing, and one with it not yet renewed. A fourth specimen has worn feathers in the wings, tail, etc., and has only the two inner primaries new. The fifth bird has many worn feathers in the wings and interscapular region, and shows only the proximal primary and a central rectrix new.

A male and a female from James Island, taken on July 28 and August 3, respectively, are in the midst of a moult involving body, wings, and tail. Five individuals from Tower, Bindloe, and Abingdon islands, secured from the 15th to the 18th of September, 1906, are in the last stages of a moult involving the entire plumage. It is impossible to say whether

it is prenuptial or postnuptial, as I have no observations on the reproductive organs.

It not infrequently occurs that some of the middle wing-coverts, when fresh, have a narrow white margin. I do not know of what significance these are.

Specimens from Baja California obtained about the middle of July, 1905, are in worn plumage. All are beginning the postnuptial moult. In one case a bird is getting a new rectrix, but in all others nothing beyond the body-plumage has been affected.

Frazar's Oyster-catcher was found to be quite evenly distributed on all of the islands named above, but seldom more than three or four individuals were seen at one time. Singly or in pairs, we met with them along the rocky coasts, where they did most of their feeding. Occasionally they were seen on the sandy beaches, which are quite extensive on the larger islands. As a rule they were very fearless, and several were killed with stones.

In traveling over the smooth beaches this species either walks or runs, being able in the latter case to travel quite rapidly. One day on South Seymour two kept just ahead of us for about one hundred yards along a beach, running slowly all the time. When anchoring at James Bay, James Island, on August 6, three flew by the vessel, and later we met them on the beach. They alighted a hundred yards or so above us, and then started on the run in our direction. They acted as though they were racing, keeping abreast most of the time, and maintaining a steady pace. When among the rocks, these birds do considerable jumping from one rock to another, often using their wings to aid them.

Their flight is nothing like that of a snipe for swiftness and gracefulness, nor is it as erratic as the Hudsonian Curlew's. Usually, when over the water, the birds fly at a height of ten or twenty feet, while along the shores they keep lower down. Their wing-beats are more rapid than a gull's.

On two occasions this species was observed swimming, but not through choice. In one case a wounded one took to the water, and, upon being approached with the boat, dived three or four times. Another individual, wounded while flying

over the water at the San Benito Islands, Baja California, did the same thing and was captured only with great difficulty.

Aside from one instance, these oyster-catchers are always noted feeding on the rocks from which they pick their food. The food consists of small chitons, small crabs, sea-slugs, and key-hole limpets, which are chiefly obtainable at low tide. These creatures are all swallowed whole.

Many times the presence of this species is made known, not by the eye, but by the ear. As a rule they call when disturbed, and when flying from place to place. The call is loud and piercing, and consists of a series of piping notes given in quick succession, and slightly resembles the call of the Wandering Tattler. Single short staccato notes are also uttered when a bird is approached.

Three specimens, which showed signs of breeding, were taken on Gardner-near-Hood on September 28, 1905. Sexual organs of birds taken at Sappho Cove, Chatham, February 14, and at Academy Bay, Indefatigable Island, July 16, were small. A female with medium-sized ovaries was taken on Narborough on March 22.

On February 1, two young ones scarcely able to fly were taken on southeast Hood. They were feeding in company with two adult birds, presumably their parents. On March 22 a young one of about the same age was taken on Narborough. Another was taken on South Seymour on July 26, and still another on northeast James on August 4.

While I was approaching a wounded one on northwest Indefatigable, one of several Galapagos Hawks roosting in the vicinity made a sudden swoop at it. Uttering a shrill cry, the oyster-catcher sought safety by jumping into the water close beside a sheltering rock. It is doubtful whether the oyster-catchers are harassed by the hawks under normal conditions.

Like the Wandering Tattler, but not to such a great extent, this species has the habit of bobbing the posterior portion of the body up and down.

One bird taken had the outer covering of the upper mandible loose and apparently ready to shed, for it was very easily detached, leaving a new, hard, and darker-colored bill beneath. Another specimen was minus the greater part of its tongue, having only about one quarter of an inch of it left.

In Baja California the species was first met with on San Martin Island, July 11, 1905, where one was seen in company with seven Black Oyster-catchers (*Hæmatopus niger*) on the shores of the lagoon. At the next stop, San Geronimo Island, July 13, eight of the first species and twelve of the second were observed, all on the rocks along the beaches. They proved fairly easy of approach, and when flying kept up a continual calling. At the San Benito Islands, July 14 and 15, Frazar's Oyster-catcher was in the ascendency, ten or a dozen being seen each day to only one of the Black, while at South Bay, Cerros Island, July 18, it was fairly common, and only two or three Black Oyster-catchers were encountered.

### Squatarola helvetica: Black-bellied Plover

Albemarle, Charles, Chatham, Hood, Indefatigable, and James islands.

The Black-bellied Plover was not common, but was observed a dozen or more times on the above islands, where it was very wild. There was an interval of three months during which the species was not seen—April 25 to July 28.

Mr. Beck reports[1] having seen two Black-bellied Plovers on Clipperton Island on November 19, 1901.

Two Wilson's Plovers (*Ochthodromus wilsoni*) were taken on Cocos Island, Costa Rica; a male on September 4 and a female on September 11, 1905.

### Ægialeus semipalmatus: Semipalmated Plover

Abingdon, Albemarle, Bindloe, Charles, Chatham, Indefatigable, James, Jervis, and Narborough islands.

Quite a number of this species were observed about the islands from July to April. The earliest bird was noted on July 17 and the latest on April 25. Like the Turnstone, they were found in the grassy uplands as well as on the coast.

On September 4, 6, and 11, 1905, a few were seen on the beach at Wafer Bay, Cocos Island, Costa Rica, where three males were secured.

[1]Condor, v. 9, p. 109.

### **Himantopus mexicanus**: Black-necked Stilt

Plate I, Fig. 2

Albemarle, Charles, Chatham, Hood, Indefatigable, James, and Seymour islands.

This noisy bird we found to be rather common on the above-mentioned islands with the exception of Hood and Seymour.

On February 25 a nest containing four eggs incubated about seven days, was found on a small flat lava-islet in the large lagoon at Cormorant Bay, Charles Island. The islet projected less than five inches above the surface of the lagoon. The nest was composed of twigs, small pieces of moss taken from the lagoon, and bits of lava placed in a slight depression in the rock. Close by were seven Flamingo nests in use. The eggs measure in millimeters, respectively: 41×29.5, 42.4×29.5, 41.9×29.8, 41.6×29.9. The Academy has of this species twenty clutches of four eggs each, from Merced County, California. All were taken by Mr. Beck in May and June, 1908, showing that, so far as known, the breeding-season in the Galapagos is much earlier than in California.

### **Numenius hudsonicus**: Hudsonian Curlew

Albemarle, Charles, Chatham, Hood, Indefatigable, James, and Narborough islands.

This species was observed quite commonly about Albemarle, Charles, Indefatigable, and James islands, proving to be a bird of the interior as well as of the shore. On Charles Island it was found in considerable numbers in the open stretches among the low trees and bushes at an altitude of a thousand feet on the west side of the island, as well as in the pasture lands of the interior. At Villamil, Albemarle Island, it was not infrequently seen perching in the tall, bare, dead trees close to the village and about the large lagoon.

From the time we arrived at the islands up to the latter part of April, curlews were fairly common. One or two individuals were noticed at Villamil as late as May 2. One was shot on Hood Island on June 25. From July 14 on, they were seen frequently.

Only one was encountered at Cocos Island, Costa Rica—a female in worn plumage, shot on the beach at Wafer Bay on

September 12, 1905. Mr. Beck reports[1] having seen one on Clipperton Island on November 19, 1901.

### Symphemia semipalmata: WILLET

Abingdon and Albemarle islands.

On November 1, 1905, a Willet was seen on the ocean beach near Villamil, Albemarle Island. Another was observed in the same locality with a small flock of Hudsonian Curlews on September 3 of the following year.

A male (No. 1980 C. A. S.) was captured on a beach on the south side of Abingdon Island, September 21, 1906.

### Helodromas solitarius: SOLITARY SANDPIPER

Chatham Island.

Two specimens are reported from Chatham Island, October 12, 1897, by Messrs. Rothschild and Hartert in the *Novitates Zoologicae*[2] for the year 1899. I know of no other record of this species from the Galapagos Islands.

### Heteractitis incanus: WANDERING TATTLER

Abingdon, Albemarle, Barrington, Bindloe, Brattle, Champion, Charles, Chatham, Culpepper, Duncan, Gardner-near-Hood, Hood, Indefatigable, James, Jervis, Narborough, Seymour, Tower, and Wenman islands.

The shrill, piping call of the Wandering Tattler was a very characteristic sound of the Galapagos coasts. As a rule lone birds were seen, but on February 1, 1906, a flock of nine was noted on Hood Island, while a flock of a dozen was seen on Clipperton Island, Mexico, on August 10, 1905. In the Galapagos Islands the species proved to be a common one, and was observed throughout the year except from April 11 to June 25. At Cocos Island, Costa Rica, during the first half of September, 1905, a few were seen along the rocky shores.

On two occasions Wandering Tattlers were seen in unusual situations. On Indefatigable Island several were seen feeding in the salt lagoons, while on south Albemarle I saw one

[1] Condor, v. 9, p. 109.
[2] V. 6, p. 188.

alight in a bare dead tree on the shore of a lagoon at least a quarter of a mile inland.

### Tringoides macularius: SPOTTED SANDPIPER

Abingdon and Albemarle islands.

A male (No. 1990 C. A. S.) shot at Villamil, Albemarle island, on May 2, 1906, was in fairly high plumage. A second individual was seen on the south shore of Abingdon Island on September 22, 1906.

In 1905, two females, Nos. 1991 and 1992, were taken on Cocos Island, Costa Rica, on September 4 and 7 respectively. Several examples were observed daily on September 4, 5, 6, 7, 8, and 11, at both Chatham and Wafer Bays.

On September 13 a female Semipalmated Sandpiper (*Ereunetes pusillus*), No. 1993 C. A. S., was taken on the beach at Wafer Bay.

### Calidris arenaria: SANDERLING

Abingdon, Albemarle, Bindloe, Charles, Chatham, Hood, James, Jervis, and Seymour islands.

The Sanderling was seen only two or three times in the saline coastal lagoons, but was fairly common on certain occasions on the ocean beaches. It was observed in July, August, October, November, February, and March. Like the Black-bellied Plover, it was very shy and difficult of approach.

### Limonites minutilla: LEAST SANDPIPER

Abingdon, Albemarle, Barrington, Charles, Indefatigable, and James islands.

The Least Sandpiper was not infrequent, being noted on all of the above-mentioned islands during the months of July, August, September, October, November, and February. On July 28 several were observed in a large lagoon on northeastern James; with them were a number of Hudsonian Curlews, Black-bellied Plovers, and Semipalmated Plovers. They haunted the ocean beaches as well as the lagoons.

A few were seen at Wafer Bay, Cocos Island, Costa Rica, on September 4 and 11, 1905, specimens being secured.

### **Heteropygia bairdi**: Baird's Sandpiper

Barrington Island.

The Webster-Harris Expedition captured a male on Barrington[1] on October 6, 1897.

A male (No. 2004 C. A. S.) was taken at Wafer Bay, Cocos Island, Costa Rica, on September 4, 1905.

### **Phalaropus hyperboreus**: Northern Phalarope

Albemarle, Indefatigable, James, and Narborough islands.

No specimens of the Northern Phalarope were taken, but we saw the species at times about the archipelago. Two or three bands of about twenty each were seen on the water on a very foggy morning, April 10, in Banks Bay, Albemarle Island.

On August 13, while sailing from Cowley Island to south James, hundreds of phalaropes, apparently of this species, were seen near the latter island. They were flying south close to the water, while a few were seen on the water. It was a cool day with a brisk southeast wind.

In the early afternoon of September 12, when about ten miles southwest of Indefatigable Island, we came upon thousands of phalaropes in large compact flocks, mostly on the water. The flocks were close together, and as far as one could see, looking from the deck towards Indefatigable, the water was dotted with them. The sky was overcast, the temperature moderate, and the usual southeast trade wind was blowing.

On August 18, 1905, in latitude 7° 24′ North, longitude 103° 52′ West, three Red Phalaropes (*Crymophilus fulicarius*) were seen, two of them being taken.

### **Steganopus tricolor**: Wilson's Phalarope

Albemarle Island.

On November 3, 1905, two males and one female were shot on a small saline lagoon about half a mile inland from the village of Villamil, Albemarle Island. They were very tame and unsuspicious.

[1]Nov. Zool., v. 6, p. 188.

The specimens are in process of moult from the juvenal plumage to the postjuvenal plumage, being in about the same stage as a young female (No. 13475 C. A. S.) taken in Merced County, California, on September 3, 1908. The upper parts, particularly the wing-coverts, still contain a good many of the feathers edged with light sandy-buff that characterize the young.

### Ardea herodias: GREAT BLUE HERON

Albemarle, Charles, Chatham, Duncan, Hood, Indefatigable, James, Narborough, and Seymour islands.

Although usually solitary, Great Blue Herons are not uncommon on the central and southern islands. They seemed to be confined to the vicinity of tide-water, and did not frequent the salt lagoons, which were the haunts of the Flamingoes and Egrets.

They lacked the wariness of northern birds, and at times would allow approach to within a few yards. On one occasion an individual followed me about on wing in a mangrove swamp, apparently from curiosity. Each time I moved away a short distance, it would leave the tree on which it had settled, and fly to another near by, and crane its neck and peer down at me. At another time one was attracted to a dead bird of the same species, although a party from the schooner was standing in plain view within twenty-five yards.

A bird with enlarged sexual organs was shot on the northwestern part of Indefatigable Island on July 23. Three months later Mr. Hunter obtained on southeastern Indefatigable a nearly naked young one, with pin-feathers just appearing, while Messrs. Rothschild and Hartert report a clutch of three fresh eggs on that island on September 2.[1] Messrs. Snodgrass and Heller found a set of three eggs on Narborough Island in January.[2] As with the Frazar's Oystercatcher, the breeding-season appears to be quite extended, or else it is later on Narborough than on the islands to the eastward of Albemarle.

There seem to be no color characters distinguishing Galapagos specimens of the Great Blue Heron from middle-Cali-

[1]Nov. Zool., v. 6, pp. 93, 115, 180.
[2]Proc. Wash. Acad. Sci., v. 5, p. 254.

fornia specimens, except that the colors of the latter average a trifle darker. A comparison of the measurements of adults from the two localities (Table VII, p. 114) show that the Galapagos specimens average smaller in length of wing, tail, and tarsus, and larger in length of culmen.[1]

### Herodias egretta: Egret

Albemarle and Indefatigable islands.

Unlike the Great Blue Heron, this species was wary and very difficult to obtain, perhaps on account of the fact that the natives hunted it somewhat for its plumage. It could be approached only under cover. A few individuals were often seen about Villamil, Albemarle Island, perching in some high tree in the midst of an impenetrable mangrove swamp, or else standing in some inaccessible part of a lagoon.

Unlike the Great Blue Heron, the Egret frequented the saline coastal lagoons, which are unaffected by tides. At Villamil, one day in March, I saw fifteen of them in the large lagoon. On November 29 one was taken in a lagoon on northern Indefatigable Island, opposite Daphne.

The measurements of Table VIII, p. 115, show that the Californian specimens average slightly larger than those from the Galapagos Islands; the series of the latter, however, is very small.

### Nyctanassa violacea: Yellow-crowned Night Heron

Plate II, Fig. 1

Abingdon, Albemarle, Bindloe, Brattle, Champion, Charles, Chatham, Duncan, Gardner-near-Hood, Hood, Indefatigable, James, Jervis, Narborough, Seymour, and Tower islands.

The Yellow-crowned Night Heron was fairly common in the archipelago, being found along the shores of the above-mentioned islands, while on Albemarle and Tower it was seen in the interior as well. Like the Galapagos Heron, it frequented rocky and cliff-bound coasts, as well as those fringed with mangroves. At Villamil, Albemarle Island, it was observed about the large saline lagoons. On Tower Island, September 14 and 15, 1906, two or three were noted a quarter of a

[1] Cf. Bangs, Proc. New England Zool. Club, v. 3, pp. 99, 100; Oberholser, Proc. U. S. N. M., v. 43, pp. 549, 550, 559.

mile inland among the rocks and bushes. On the east side of Cowley Mountain, Albemarle Island, on August 10 and 11, the tracks of these birds were noted in the dust of the donkey trails at an altitude of about twenty-four hundred feet, and an immature bird was seen. On August 30, at the village of Santo Tomas, Albemarle Island, at an altitude of about twelve hundred feet, a peon brought in an immature one which he had caught early that morning. On other islands they were often found in the brush a short distance from the beach, but never up in the mountains, as on Albemarle. Like the Galapagos Heron, this species proved a very easy one to approach.

A male, taken on Duncan Island on December 2, and showing traces of immaturity, had enlarged testes. Four adults taken on June 25 on Hood Island had small sexual organs, as had an adult male taken at Academy Bay, Indefatigable Island, on July 16. The same remarks also apply to a specimen taken in a cavern on Abingdon Island on September 22, 1906.

A nest of this species was found on March 10, on a point thickly clothed with mangroves, which jutted into the large lagoon beside the road leading inland from Villamil. The nest was a bulky affair placed in a low flat bush about two and a half feet above the ground. It was built of twigs and lined with grass, and contained four pale greenish-blue eggs, nearly ready to hatch. On March 15 another nest was found a short distance from the beach about two miles west of Cape Rose, Albemarle Island, and it contained two very small young.

On July 28, 1905, three Yellow-crowned Night Herons were seen in the brush near Braithwaite Bay, Socorro, Revilla Gigedo Islands, and one was secured. On Cocos Island, Costa Rica, during the first half of September of the same year, they were not infrequent, being seen in the trees and along the fresh-water streams.

The material from Socorro and Cocos in the Academy's collection is very inadequate. An adult male from Socorro and one from Cocos are both slightly paler than adults from the Galapagos Islands. The measurements given in Table IX, p. 115, are all from adults, except those of Cocos specimens, in which case an adult male and an immature male were measured. The two Cocos males have larger bills than the Gala-

pagos males, a difference which strikes the eye instantly when looking over the series. The measurements of a female from Camden County, Georgia, in the collection of Mr. Joseph Grinnell, are included in the table.

In the Academy's series are six Galapagos specimens in juvenal plumage, and showing no signs of postjuvenal moult. They are as follows: No. 2064, Seymour, November 22; No. 2063, Charles, February 26; No. 2065, Hood, June 25; No. 2066, Indefatigable, July 16; No. 2061, Albemarle, August 11; No. 2058, Albemarle, August 31. Of these six specimens, three still have the remains of down attached to the feathers of the crown; viz., Nos. 2064, 2065, and 2058. The above series would seem to indicate that the breeding-season for the species continues throughout the year.

No. 2062, Cocos Island, September 4, 1905, is beginning to moult the juvenal plumage, pin-feathers appearing in the back and about the head and neck. I am unable to say whether the moult is the postjuvenal or the prenuptial. No. 2054, Albemarle, March 5, is evidently undergoing a similar moult, which likewise has not proceeded beyond the body-feathers, although it has been pretty well completed on the head and neck. The same remarks apply to No. 2060, Albemarle, March 5, and to No. 2059, Albemarle, March 10.

Three specimens are in a striped immature plumage, which evidently completely replaces the juvenal plumage, but whether by a postjuvenal or a prenuptial moult, I cannot say. In this plumage, pale-brown occipital plumes and dusky scapular plumes are present, and the black chin and throat of the adult are faintly indicated. Our specimens were taken as follows: No. 2057, Hood, September 29, 1905; No. 2056, Brattle, October 30; No. 2055, Indefatigable, November 20.

Birds with the black of the throat unbroken, but showing immaturity otherwise, were not uncommon. This immaturity usually took the form of a generally duskier and more brownish (rather than bluish) cast to the entire plumage, and also of more or less streaked under parts. No. 2052, Hood, June 25, is evidently passing from the plumage last described into this one. No. 2053, from Cocos Island, September 8, 1905, has white feathers intermingled with the black ones of the throat and chin.

No. 2030, a fine adult male from Cocos Island, is in fresh plumage and still shows numbers of pin-feathers. No. 2032 from Socorro, July 28, is in worn feather.

### Butorides sundevalli: GALAPAGOS HERON

Plate II, Fig. 2

Abingdon, Albemarle, Barrington, Bindloe, Champion, Charles, Chatham, Daphne, Delano, Duncan, Gardner-near-Hood, Hood, Indefatigable, islet off northeast James, James, Jervis, Narborough, Seymour, Tower, and Wenman islands.

This fearless, and to our minds ludicrous, heron frequented the rocky and cliff-bound coasts as well as those clothed with mangroves, its dusky color blending admirably with the lava rocks and rendering it very difficult to see, especially when not in motion. It was also observed quite commonly in the large saline lagoons near Villamil, Albemarle Island.

In two or three instances individuals were observed sitting on the bowsprit of the schooner while anchored at Tagus Cove, Albemarle Island. One day at Charles Island, upon returning from a short trip inland, we found an immature one in the bottom of the skiff, which was drawn up on the beach. It was quietly investigating the water under the grating. When we threw our things into the boat, it jumped up on a thwart, where it remained until one of the members of the party got a stick and dispatched it.

When a stone is thrown close to one of these birds, or it is come upon suddenly, it often jumps two or three feet to a neighboring rock, raising its crest and cackling and squawking in great alarm. Often if a person rows by one in a skiff at a distance of thirty or forty feet, it will make a great racket, craning its neck absurdly all the while—a habit which affords much amusement to the onlookers. When excited or disturbed, these herons bob their tails up and down continually with a short twitching motion.

Very often they were observed flying across bays and toward adjacent islands. They do not fly with the neck outstretched, but carry the head close to the shoulders, giving the body a hunched appearance. The same is true of their walk. One was watched carefully one day on Indefatigable Island. It

walked along, jumping from rock to rock and keeping hunched up all the time. Upon sighting its prey, it advanced slowly and stealthily, keeping behind rocks as much as possible until within striking distance, when suddenly its head shot forth and the fish was caught. On another day in the same locality I watched for fully ten minutes one trying to swallow a crab, and then had to leave without witnessing the conclusion. The crustacean was held crosswise in the bird's bill, and to all appearances was too large to be swallowed. Nevertheless the bird stood tenaciously in one spot, and made occasional unsuccessful gulps.

Enlargement of the sexual organs was noted in adults taken on Hood Island in September, on Indefatigable and Seymour in November, on Chatham in February, and on Abingdon in September. The sexual organs of two birds taken at Iguana Cove, Albemarle Island, on March 17 were small.

The only occupied nest discovered was in a mangrove thicket on a small islet at Sappho Cove, Chatham Island, February 10. It was about twenty-five feet from the outer edge of the thicket, and perhaps four or five feet above high water. It was composed of twigs, was not particularly bulky, and contained three greenish eggs, pipped and ready to hatch. Both of the adults were present and kept up a continual squawking while the nest was being examined. One stayed on the nest, except when approached very closely, when it would move away two or three feet, darting its bill at us continually.

On Narborough on April 18, I killed, with a stone, a young one which was just able to fly and fish for itself. Immediately its parent flew towards it screaming and with crest upraised. A similar instance was observed two or three days before at Banks Bay, Albemarle Island.

The Academy's series of adults exhibits a dichromatism. Three adult males from Chatham Island are of the pale phase, one (No. 2166 C. A. S.) extremely pale; a fourth male (No. 2137 C. A. S.) is rather intermediate, as is the only female from that island. A male (No. 2167 C. A. S.) from Banks Bay, and a female (No. 2168 C. A. S.) from Indefatigable, closely resemble the Chatham males. Throughout the series of adults there is considerable variation in color, most of the birds inclining to the dark extreme. From the Academy's

series and from the remarks by Mr. Ridgway,[1] it would appear that the extreme pale phase of this species is known only from Chatham, Indefatigable, and Albemarle Islands. In the extreme pale examples, the under tail-coverts are white or very pale gray with subterminal black spots, and there is a more or less distinct grayish-white postocular streak. The pileum and occipital crest are of the same color as in the dark phase, while the throat is white instead of gray. In many of the specimens of the dark phase the chin and throat have absolutely no white, but are pale gray mottled with darker gray. Breeding individuals of the pale phase seen at Sappho Cove in February had noticeably red tarsi and toes.

The series of young and immature birds shows considerable variation also. In the majority of cases the ventral aspect is dusky as described by Mr. Ridgway. Two specimens, however, from Cowley Bay, Albemarle Island, and from Narborough respectively, are noticeably white below. Some specimens have the terminal triangular white spot on the four outermost primaries as well as on the others. In very dusky examples the rusty shaft-streaks are lacking in the feathers of the pileum and occipital crest. In some specimens the back and scapulars are not of uniform deep sooty brown, but have broad cinnamon-rufous mesial stripes, and the wing coverts are similarly marked. No. 2144, Jervis, December 18, is an excellent example. No. 2152, Indefatigable, July 23, has narrow pale mesial stripes. No. 2148, Indefatigable, January 22, in which the juvenal plumage is not yet fully developed, shows beautiful green reflections on the feathers of the upper parts.

Two adults showing albinistic feathers were taken on Indefatigable Island in latter November. One had a white feather in the side of the neck, the other a white secondary. No. 2119, adult male, from south Albemarle, has the tertiaries a dark shining green, like the end of the tail, for about one quarter-inch at the distal end. This color is in the form of a terminal band. A similar terminal band, much interrupted, is formed by this color on the tail.

The Academy's series of skins of this species numbers 102. Forty-five adult males show the dimensions, in millimeters,

[1]Proc. U. S. N. M., v. 19, p. 605.

of that sex to be: Wing 176–198 (186); tail 57–71 (63); culmen 62–71 (67.3); tarsus 44.3–52.3 (48.6); middle toe 42.9–49 (45.6). Thirty-six females yield the following measurements: Wing 169–192 (183); tail 56–70 (63.8); culmen 58.1–69.2 (65.4); tarsus 43.4–51.2 (47.4); middle toe 39.3–46.5 (44).

Table X, p. 116, giving measurements of specimens by islands, shows that there is no variation in size with locality, but that obviously all the variation in size is individual. It cannot be correlated in any way with the color phases.

Birds in juvenal plumage showing no signs of moult were taken during nine months of the year, and consequently prove to a certain degree the wide range of the breeding-season of this heron. They were taken as follows: November 25, Indefatigable; December 18, Jervis; January 22, Indefatigable; March 24, Albemarle; April 18, Narborough; May 23, Charles; June 28, Hood; July 14 and 23, Indefatigable; September 22, Abingdon.

Birds in juvenal plumage with the renewal taking place chiefly in the scapular and interscapular regions were taken as follows: September 27, 1905, Gardner-near-Hood; October 24, Barrington; November 8, Indefatigable; November 22, Seymour; January 5, James; July 16, Indefatigable; August 11, Albemarle; September 22, 1906, Abingdon. No. 2163, Indefatigable, January 11, is somewhat farther along than the above specimens, and has a good many new gray feathers in the lower parts. No renewal seems to have yet taken place on the wings, the feathers being those assumed with the juvenal plumage.

A study of the Academy's series of adults reveals the two following points: The immature birds assume the adult plumage at the first prenuptial moult, which evidently involves the wings and tail as well as the body. The adults also have a complete prenuptial moult.

### **Butorides virescens**: Green Heron

The Green Heron was not an uncommon bird on Cocos Island, Costa Rica, where a number were seen in the tall forest trees and along the streams in September, 1905.

August 8, 1913

The following table gives the measurements of seventeen specimens in the Academy's collection.

MEASUREMENTS (in millimeters)

| Number | Sex | Age | Locality | Wing | Tail | Culmen | Tarsus | Middle Toe |
|---|---|---|---|---|---|---|---|---|
| 18396 | ♂ | Adult | Ohio | 181 | 60 | 65.1 | 49. | 44.2 |
| 13703 | ♂ | Adult | California | 195 | 66 | 60.8 | 49.9 | 46.6 |
| 13705 | ♂ | Adult | California | 198 | 61 | 57 | 50.8 | 46.5 |
| 13704 | ♂ | Adult | California | 196 | 73 | 62.2 | 50.5 | 46.2 |
| 12959 | ♂ | Immature | California | 201 | 68 | 61 | 51.7 | 45 |
| 12408 | ♂ | Immature | California | 193 | 66 | 56 | 50.9 | 45.6 |
| 2172 | ♂ | Immature | Cocos | 172 | 60 | 61.8 | 46.9 | 42.8 |
| 2173 | ♂ | Immature | Cocos | 180 | 63 | 59.8 | 49.4 | 42.5 |
| 2170 | ♂ | Immature | Cocos | 176 | 61 | 58.6 | 49.1 | 45.1 |
| 2169 | ♂ | Immature | Cocos | 174 | 59 | 55 | 49 | 45 |
| 13702 | ♀ | Adult | California | 201 | 70 | 56.5 | 49 | 45 |
| 12411 | ♀ | Immature | California | 198 | 67 | 59.1 | 50.6 | 45.8 |
| 12409 | ♀ | Immature | California | 185 | 65 | 56 | 50.1 | 44 |
| 12410 | ♀ | Immature | California | 192 | 64 | 52.5 | 51.7 | 46 |
| 12220 | ♀ | Immature | California | 192 | 67 | 56.3 | 49.3 | 44.6 |
| 2174 | ♀ | Immature | Cocos | 174 | 59 | 58.1 | 48.1 | 43.3 |
| 2171 | ♀ | Immature | Cocos | 177 | 61 | 56.3 | 50.5 | 47.8 |

The following summary of the above measurements shows that Cocos specimens average decidedly smaller than California specimens in length of wing and of tail, closely approaching the Ohio specimen in this regard. These averages are made without regard to age.

SUMMARY OF MEASUREMENTS (in millimeters)

| Locality | Sex | Number of Specimens | Wing | Tail | Culmen | Tarsus | Middle Toe |
|---|---|---|---|---|---|---|---|
| Ohio..... | ♂ | 1 | 181 | 60 | 65.1 | 49 | 44.2 |
| California... | ♂ | 5 | 197 | 67 | 59 | 50.8 | 46 |
| Cocos..... | ♂ | 4 | 176 | 61 | 58.8 | 48.6 | 43.9 |
| California... | ♀ | 5 | 194 | 67 | 56.1 | 50.1 | 45.1 |
| Cocos..... | ♀ | 2 | 175 | 60 | 57.2 | 49.3 | 45.5 |

## Phœnicopterus ruber: American Flamingo[1]

Plate III

Albemarle, Charles, Chatham, Indefatigable, James, and Jervis islands.

[1]Cf. Chapman, "A Contribution to the Life History of the American Flamingo (*Phœnicopterus ruber*), with Remarks upon Specimens," Bull. Am. Mus. Nat. Hist., v. 21, pp. 53-77.

Flamingoes were not abundant. Albemarle, Charles, and James seemed to be the most frequented islands, and about thirty was the largest number of birds seen in one flock at one time. On Indefatigable Island they were very scarce, only two being taken; and likewise on Jervis, where a young one was found in the small lagoon on the north side of the island. On Chatham Island a dead one was found on the shore of the tidal lagoon near the warehouse at Wreck Bay. This bird, we were told, had been brought over alive from Charles Island. The lagoon at the base of the precipitous mountain known as Finger Point, near Sappho Cove, Chatham Island, appeared to be a suitable one for flamingoes; but none were found there.

The salty coastal lagoons seemed to be the sole haunts of these birds. These lagoons are unaffected by the tides, and are therefore saturated solutions of salts, their shores often being paved with crystalline deposits. Their beds are usually composed of reddish mud, sometimes quite hard and firm. The shores, as a rule, are fringed with mangroves and salt-loving bushes, which in many cases grow in almost impenetrable thickets. Some of these lagoons are bounded by bare lava.

With only one or two exceptions, it was not difficult to get within shot-gun range of the flamingoes, and the discharge of a gun usually caused them to fly only a short distance.

Where the ground is clear, and the bird's movements are unimpeded by rocks and bushes, the flamingo is a good runner, being able to cover ground very rapidly, and giving a person a lively chase. At James Bay, James Island, a young bird not quite able to fly got through the bushes from the lagoon to the ocean beach. I pursued it for nearly half a mile south along the beach late one afternoon. I was, however, unable to overtake it before it reached the rocks at the end of the beach. Perceiving that it would be caught if it remained on the beach, the bird stepped into the water and struck boldly out from shore, swimming over an eighth of a mile. As soon as I left the beach, it returned and commenced walking up and down again in the attempt to find its way back to the lagoon. The following morning it had disappeared.

In the lagoons I have seen them walking both in long Indian files, and, when disturbed, in compact bunches. Early one morning we came upon a flock of twenty-eight in the lagoon at Cormorant Bay, Charles Island. The placid surface of the lagoon, overshadowed by a high and steep mountain on its southeast side and surrounded by rocks and trees, together with the beautiful roseate birds following one another in solemn procession the whole length of the lagoon, made a very attractive picture.

At a lagoon four or five miles northwest of Sullivan Bay, James Island, on July 28, an adult bird was found without flight feathers.[1] New ones were just appearing, which were very tender, bleeding profusely when bruised. This bird was a fast runner, racing up and down the smooth beach of the lagoon, until finally it was chased into a cul-de-sac. It tried to escape through the brush, but of course tripped and fell, bruising its wings, feet, and bill. It realized its inability to fly, for it did not make any attempt to use its wings until the very last. When carried under the arm it kept its head at a level with mine, and did not try to strike with its heavy bill, but simply looked at me wonderingly. This bird was taken aboard the schooner, where it had great difficulty in standing, owing to the rolling of the vessel. It managed to do so, however, by using its head and neck as a third leg. The same thing was noted later with the young. The head and neck are used in a like manner to assist a bird in steadying itself when arising from a sitting posture.

As compared with the adults, the young walked clumsily. In running in the shallow water as well as on the land, they kept their wings outspread, flapping them at each step, apparently balancing themselves by this means. I saw one stumble, and one youngster, partially in the down, stepped in a hole in the beach and broke one of its tarsi.

We first saw this species at Cormorant Bay, October 4, when three or four flocks of about a dozen birds each flew by the vessel, having been disturbed by some of the party who had gone ashore. They seemed to be all neck and legs when flying, as they carried those members stretched out horizontally. Their wing beats were not rapid, but were moderate

[1]Cf. Beck, Condor, v. 4, p. 99; v. 6, p. 10; Bonhote, Ibis, 1903, p. 310; Chapman, Bull. Am. Mus. Nat. Hist., v. 21, p. 76.

—being faster than those of the Great Blue Heron, but slower than those of the Bahama Pintail. When forced to fly from a lagoon, they usually circled about several times, apparently very reluctant to leave, and often settling again instead of flying off. They were seldom, if ever, seen in flight except when disturbed. Nevertheless they must move about considerably, for the numbers in the respective lagoons varied at different seasons, and in several instances varied overnight.

These birds were always observed feeding in the water, often standing in it up to and even above the lower edge of the feathered portion of the tibiae. In this position they feed upon the bottom of the lagoon, affording a strange spectacle with neither head nor legs in sight. Specimens were taken with the gullet full of what appeared to be reddish mud.

Nests of this species were found on Charles and James Islands, at Cormorant Bay on the former island and at James Bay and near Sullivan Bay on the latter. The nests were built of earth and mud scraped together into a pile with steep sides, sometimes being as much as a foot in height and the same in diameter across the top. Usually they were about seven or eight inches high. The depressions in the tops were about an inch or an inch and a half deep. The nests were always built near the water, either on some very low, flat, rocky islet or on a beach. On the east side of the lagoon at James Bay, there were thirty-five nests on the narrow beach at the edge of the brush. Twenty-five were strung along close together, and a few feet to the northward were ten more. When we visited that locality in early August many of them showed signs of recent use, to which the presence of the young birds also testified. Some, however, had not been occupied that year. About a dozen addled eggs were found, one to a nest, while the remaining nests were vacant. On our previous visit in December there were no eggs, so without a doubt these were laid in 1906. Evidently at least a third of the eggs laid in that locality during that year were infertile.

At Cormorant Bay, on February 25, we found six mounds of earth between four and eight inches high, each with one fresh egg. They were on a low lava-islet in the northeast corner of the large lagoon. No nests were found with lining other than mud and earth. A seventh fresh egg was laid on

a level bit of lava rock, with mud half an inch deep scraped around it. The birds all left when approached within thirty yards.

In a lagoon about four miles northwest of Sullivan Bay, on July 28, nine unoccupied nests were found, seven of which were on a small, low, lava-islet, the remaining two being on the adjacent mainland. They were built in the usual style, but were, however, only four or five inches high. An addled egg was found in one. Undoubtedly the nests of the flamingoes in the Galapagos Islands are not endangered to any great extent by the rise of the water, as are the nests of their Bahama relatives; hence, perhaps, many are built very low.

The following notes were made at James Bay in August: August 6, there were twelve flamingoes in the lagoon, one adult and eleven young, three of the latter being large enough to fly. The remaining eight still showed more or less down. Two or three dead young with nearly straight bills were found. They were considerably younger than the ones taken. Two full-grown young were feeding apart from the others. They were approached quite closely and photographed, proving less wary than the adults. August 7, an additional adult had arrived during the night. One of the larger young birds was observed to go through a strange performance; it seemed to be butting an adult. They were all on the beach at the time. The young one would lower its head and bump against the adult with its shoulders; the latter paid very little attention, merely trying to get out of the way. The performance was kept up for about five minutes. Was the young bird begging to be fed? I had seen it feeding itself—in fact they all seemed to do so, the young apparently being left to themselves most of the time, judging from the absence of the parents. August 8 revealed four adults in the lagoon. There were two lagoons south of the one here mentioned, but they did not seem to be used by the flamingoes for breeding purposes.

The chief associate of the flamingo was the Bahama Pintail, while the Black-necked Stilt ranked second.

The colors of the naked parts in life were as follows:

Adult—Terminal third of bill black; remainder of mandible whitish tinged with scarlet; remainder of maxilla, throat, and skin in front of the eyes whitish; orbital ring buff; iris straw-

yellow; tarsus and toes scarlet; under side of toes and webs flesh-colored. Maxillæ of very high-plumaged adults are tinged with scarlet from the black of the anterior portion to the posterior end of the nostrils.

Juvenal plumage—Iris dark brown; orbital ring olive-buff; bill olive-buff, tipped with plumbeous; skin in front of eyes and throat cinereous; tarsus and toes olive-gray, blackish slate at joints; under side of toes and webs mouse-gray. As the birds age the tip of the bill becomes darker.

The Academy's series of flamingo skins, all from the Galapagos Islands, numbers seventy, and includes specimens taken in every month of the year except March, April, and June.

The series of young birds is passing into the plumage called by Mr. Chapman the "third or juvenal plumage."[1] The youngest bird matches No. 3 of Fig. 16 of Mr. Chapman's paper. As the grayish-brown down disappears from the tips of the feathers of the under parts, the pale pink plumage is more clearly disclosed, showing many of the feathers on the breast and flanks with dark shafts. By lifting the feathers of the under parts, the gray downy teleoptiles can be seen. The youngest bird shows these very distinctly. With the next moult these become paler, and in birds fully adult are white. The feathers of the upper parts, particularly the scapulars and interscapulars, show wear very quickly, for even in the youngest bird they are somewhat abraded. Pale pink feathers put in an appearance on the head, whence they seem to work by degrees down the neck, appearing here and there and giving it a pink-and-gray mottled appearance. At this stage the scapulars and interscapulars are much worn and pointed, and the primaries are developed enough to enable the bird to fly. All of the young thus far mentioned were taken at James Bay, August 6 to 9, showing that there must be considerable variation in the time of egg-laying in a colony. No. 2236, James Island, December 26, is in very much worn and faded juvenal plumage, but shows no signs of moult.

Two specimens (No. 2234 from Jervis Island, December 18, 1905, and No. 2237 from James, December 28, 1905) are moulting from the juvenal or third plumage into a fourth plumage—not the full adult plumage, however, but a pink

[1]Bull. Am. Mus. Nat. Hist., v. 21, p. 72.

plumage with dusky mesial stripes on many of the feathers of the upper parts. These two specimens also show pink feathers replacing the worn faded feathers of the head and neck, and apparently working from the head downward. The bases of the new feathers appearing in the head and neck are gray as in the juvenal plumage, and not white as in fully adult specimens. No. 2232, October 5, and No. 2238, February 26, both from Charles Island, seem to show this fourth plumage somewhat farther advanced. Scarlet upper wing-coverts, occasionally with dark shafts, are appearing, and pink feathers are replacing the worn, faded feathers of the under parts. Pinkish-white feathers are also taking the places of the long bicolored scapulars, and new upper tail-coverts are appearing. No. 2238 shows the old and new upper wing-coverts in alternating rows. No. 2208, south Albemarle, May 1, is still farther along, yet shows outward signs of immaturity in the wing-coverts, scapulars, tertials, upper tail-coverts, tail, and the dark color of the naked parts. Many old worn feathers of the third plumage are still to be found in the neck, hidden beneath the new feathers, which, as mentioned above, have dark bases. To sum up, the five immature birds just discussed are all in moult, apparently from the juvenal plumage to a plumage superficially adult, but distinguished from the full adult plumage by its paleness, by the dusky bases of the feathers of the head and neck, by the dark shafts of the axillaries, and by the more or less frequent occurrence of dorsal feathers with a dark mesial stripe or at least a shaft partially dusky subterminally. For the sake of convenience this plumage will be spoken of as the fourth plumage.

The following table gives the measurements in millimeters of all the young and immature specimens, referred to in the foregoing account, arranged according to age, as apparently indicated by the plumage.

MEASUREMENTS OF IMMATURE BIRDS (in millimeters)

| Number | Date | Island | Sex | Wing | Tail | Culmen | Tarsus | Middle Toe and Claw |
|---|---|---|---|---|---|---|---|---|
| 2203 | Aug. 6, 1906 | James | ♂ | 145 | | 93 | 139 | 71 |
| 2200 | Aug. 9, 1906 | James | ♂ | 203 | | 95 | 142 | 72 |
| 2202 | Aug. 7, 1906 | James | ♀ | 241 | 49 | 99 | 154 | 69 |
| 2231 | Aug. 7, 1906 | James | ♀ | 244 | 37 | 99 | 153 | 68 |
| 2230 | Aug. 8, 1906 | James | ♀ | 261 | 50 | 102 | 145 | 70 |
| 2204 | Aug. 7, 1906 | James | ♀ | 322 | 69 | 113 | 157 | 70 |
| 2205 | Aug. 7, 1906 | James | ♀ | 305 | 74 | 111 | 167 | 73 |
| 2206[1] | Aug. 8, 1906 | James | ♀ | 367 | 106 | 118 | 190 | 86 |
| 2201 | Aug. 7, 1906 | James | ♀ | 340 | 99 | 115 | 177 | 77 |
| 2233 | Aug. 6, 1906 | James | | 361 | 112 | 114 | 180 | 75 |
| 2235 | Aug. 7, 1906 | James | ♀ | 348 | 95 | 119 | 183 | 76 |
| 2236 | Dec. 26, 1905 | James | ♂ | 361 | 111 | 115 | 187 | 77 |
| 2234 | Dec. 18, 1905 | Jervis | ♀ | 359 | 114 | 113 | 202 | 73 |
| 2237 | Dec. 28, 1905 | James | ♀ | 368 | 112 | 118 | 190 | 80 |
| 2232 | Oct. 5, 1905 | Charles | | 353 | 102 | 111 | 215 | 76 |
| 2238 | Feb. 26, 1906 | Charles | ♀ | 367 | 107 | 116 | 252 | 78 |
| 2208 | May 1, 1906 | Albemarle | ♂ | 408 | 123 | 127 | 295 | 90 |

Birds showing the fourth plumage, usually mixed with either the third or the fifth, are common in the Academy's series, and have been included in the measurements of adults, for to all outward appearances they are adult. Occasional specimens in this plumage have dark edges to the rectrices, but this was also noted in one full adult. I am not prepared to say positively whether the primaries of this fourth plumage are those of the third, but apparently they are, as are also the axillaries. Just how long a time elapses between the hatching of the chick and the assumption of the adult plumage is hard to say, as the birds evidently breed at different times of the year on different islands, making it exceedingly difficult to judge from a series of skins alone. However, I believe that the full adult plumage is assumed at the first postnuptial moult.

Nineteen specimens in the Academy's collection show the fourth plumage in some stage. One October specimen from Charles Island retains tertials of the third plumage, and has worn feathers of that plumage hidden beneath the feathers of the neck. Otherwise it is in worn fourth plumage, with new feathers of the fifth plumage putting in an appearance in the

[1]No. 2206 has not lost the down from the tips of the feathers of the breast, yet it is a larger bird than No. 2201, which has lost it.

interscapular region and on the breast. The axillaries are dark-shafted and worn, and are evidently retained from the third plumage. Another October specimen from Charles Island is in almost complete fresh fifth plumage, including axillaries, but still shows a good many dark-based feathers in the neck and worn feathers in the back. Four other Charles Island specimens, taken in early October, are in transition also; the two individuals just mentioned, however, give the extremes. It would seem from the second individual, that some specimens at least attain the full adult plumage in latter October or November. Other transition birds, some showing remains of the third plumage in the neck, were taken in January, February, May, and July. No. 2196, male, James Island, July 28, is assuming the fifth or adult plumage—new abdominal feathers, axillaries, primaries, upper wing-coverts, and rectrices are appearing, the primaries and rectrices not being full grown. Elsewhere the moult is in progress. The new axillaries have red instead of dusky shafts, a characteristic of the adult bird. Evidently the first loss of the primaries occurs during the moult from the fourth to the adult plumage. One specimen, No. 2225, has an abnormal black feather at the base of the neck; this feather belongs to the fourth plumage. It would seem that the plumage which I call fourth is either the postjuvenal or the first prenuptial, and is obtained by a partial moult. The fifth plumage is evidently the first postbreeding plumage.

Thirty specimens are fully adult. The feathers of the head and neck have white bases, the axillaries have red instead of black shafts, the body-down is white, and, in some February, July, and August specimens, the lower mandible is tinged with red just posterior to the black of the outer third. These thirty specimens were taken in October, November, December, January, February, July, and August.

Three October specimens from Charles Island are worn, and exhibit feather-growth in the head, neck, back, breast, and abdomen.

No. 2187, Indefatigable Island, November 25, is in worn faded plumage. New feathers, paler than normal, are appearing in the head, neck, back, and lower parts.

Of three specimens from James Island, taken in latter December, one is a female in fine fresh plumage save for a few old scapulars and interscapulars, which are being replaced. The other two specimens are worn birds in process of moult, one being also much faded. The new feathers appearing in this bird are abnormally pale.

This brings us to a fine male taken on southern Indefatigable Island on January 11. This bird has pretty well renewed its plumage, although the moult is still in process on the back and in the tail. Both wings show the primary coverts being renewed, while in the right wing the two outer primaries are lacking, and new ones are just appearing, still enveloped in their sheaths. This is evidently not a normal state, and it may have been brought on by an accident.

Fourteen adults were taken on Charles Island on February 26. These all show some wear in varying degree, but apparently very little fading; for the color of the breast and lower neck is much intensified in some by the wearing away of the pale margins of the feathers, leaving them pointed instead of rounded. Some specimens show remnants of the previous plumage. One or two others show a few new feathers appearing in the back and breast, either belated arrivals of the present plumage or early heralds of the next plumage.

Seven specimens from James Island, taken in late July and early August, show new feathers, and seem to be coming into full fresh plumage (undoubtedly the postbreeding), although they are by no means all at the same stage. Two are much faded, and, as in other very pale specimens, the new feathers appearing in the neck, breast, and back are paler than normal. Both have worn red feathers at the base of the fore-neck, among which new pale feathers are appearing in conformity with other new pale feathers. One specimen also exhibits a large amount of red on the lower mandible. The other specimen shows some new pinkish white feathers appearing among the bright red ones of the abdomen. In pale specimens the wings and tail seem to be normal in coloration, and four such specimens show patches of worn red feathers on the lower fore-neck. The pallor elsewhere is not that of immaturity, for the birds are fully adult.

One specimen, taken on south Albemarle on September 3, is in about the same stage as some of the July and August birds from James, in which the moult is well along.

From the evidence given above, it appears that in adults the plumage is entirely renewed during the latter half of each year after the breeding season,[1] which occurs in the first half of the year.

The measurements (in millimeters) of twenty adult males and twenty-three adult females yield the following extremes and averages: Males—Wing 381–439 (413); tail 122–154 (139); culmen 117.4–132.3 (125.6); tarsus 253–322 (295); middle toe 80–91.9 (86.4). Females—Wing 370–412 (384); tail 120–143 (132); culmen 115–126 (119.5); tarsus 241–306 (258); middle toe 73.9–89 (77.9).

Five fresh eggs from Charles Island measure in millimeters as follows: 83.5×50.9, 87.3×52.4, 89.4×51.1, 85.8×52.6, 86.9×52.5. They all fall below the average given by Mr. Chapman for ten eggs from the Bahama Islands—90.2×53.9.[2]

### Pœcilonetta bahamensis: BAHAMA PINTAIL

Albemarle, Barrington, Charles, Chatham, Duncan, Hood, Indefatigable, James, Jervis, and Seymour islands.

The Bahama Pintail was common on Albemarle, Charles, Chatham, Indefatigable, James, and Seymour islands, as many as one hundred being seen together on south Albemarle. Other expeditions have reported them from Barrington, Duncan, and Hood islands, localities in which they were not observed by us. In the crater-lake at Tower Island, four ducks were observed swimming about, but as I was on the rim of the crater two or three hundred feet above them, they could not be positively identified.

The species was most common about the salt lagoons of the low coastal regions, where it associated largely with the American Flamingo and the Black-necked Stilt, and, to a lesser degree, with the Sooty Gull, the Blue-winged Teal, the Egret, and the Galapagos Heron. It also frequented the fresh-water

[1] "Mr. G. M. Green of San Francisco reports having found the flamingoes breeding in the salt marshes about James Bay on James Island, and he obtained eggs in August." (Snodgrass & Heller, Proc. Wash. Acad. Sci., v. 5, pp. 253, 254.) It is not stated whether the eggs were fresh. Those found by the Academy expedition at James Bay in August, 1906, were addled.

[2] Bull. Am. Mus. Nat. Hist., v. 21, p. 61.

ponds and lakes in the elevated portions of some of the islands. Only once were any seen on tidal water, and that was when a pair alighted in a quiet cove about three miles west of Cape Rose, Albemarle Island. Often they were noted sitting about on small lava islets and rocks in the lagoons, standing on one foot a good part of the time.

The haunts of these ducks must vary, as the smaller lagoons and ponds often dry up. In November, thirteen were encountered in a lagoon on South Seymour, where during the following July only the dry bed of the lagoon was to be seen. Sometimes one or two ducks would be seen in a locality, while at a later or an earlier visit they were more abundant—all this going to show that they must move about from place to place. In fact, on several occasions they were observed in flight along the coasts, usually, however, only one or two at a time.

In a flock seen at South Seymour in November, males were noted chasing each other, apparently in jealousy, and sometimes one would chase a female. Some low quacking is heard during the mating season, and it was particularly noted at Charles Island in February.

The following remarks on the reproductive organs tend to show a long breeding-season:

October 5 and 6, Cormorant Bay, Charles Island. Two males with swollen testes.

November 6, Academy Bay, Indefatigable Island. A female with enlarged ovary.

January 11, south Indefatigable. Four skinned, all but one having enlarged genital organs.

July 28, four miles northwest of Sullivan Bay, James Island. Nine taken with large genital organs.

We never found what was beyond doubt the nest of this species. At Cormorant Bay on February 25, a single fresh egg was found on the bare rock of a low lava-islet in the large lagoon at that place. Stilts and flamingoes were nesting on the same islet.

Young in the down were observed only near Villamil, Albemarle Island, in the salt lagoons about the cultivated lowlands. On March 5 a parent bird was noted swimming with three or four downy ducklings, and on the 6th several more young were seen. Four days later a few were encountered in

another lagoon accompanied by both parents. They kept well to the center of the sheet of water when they perceived us, traveling just as fast as their feet could propel them. Half a dozen ducklings, accompanied by their mother, were discovered in another pond about half a mile inland on August 24. As she swam out from the mangroves, they tailed after her. The above dates point to two broods being hatched during a season, or else to a wide range of time in the breeding-season in one locality.

For the most part these ducks were fearless, and usually would swim towards a person, sometimes close enough to be killed with a stone. After the first discharge of a gun, those of a flock not killed or injured would sit on the water bewildered, thus giving ample time to reload. Sometimes they flew off a short distance and occasionally circled close to the hunter. On Charles and Chatham islands they were somewhat wary at times, perhaps because of persecution by the natives. They were also cautious when in charge of their young. In one case, when the parent observed me, it led the ducklings into some thick grass, and then came out and swam back and forth in an obvious effort to decoy me from them.

A drake, caught on Seymour Island in November, and kept alive a couple of weeks in a cage, was accustomed to hiss at me every time I approached, and he would also threaten to bite.

In living specimens, the space on each side of the upper mandible near its base is yellowish or orange in the female, and reddish in the male, being brightest in the breeding-season. In the male, at least, some of the redness is perhaps caused by blood, for when pressed the patch loses its red color just as does one's finger when squeezed. The reddish color returns in a like manner when the pressure is removed.

In some males, notably No. 2287 C. A. S., the dusky grayish-brown feathers of the upper-back are trisected by two transverse bars of pale brown, the outer one distinct, the inner one less so. In other males and all the females, these feathers are dusky grayish-brown with paler margins, usually without transverse bars, or with only the outer one faintly indicated.

In four specimens taken on south Albemarle on November 1, the postjuvenal or the first prenuptial moult is started. The juvenal plumage is a very weak washed-out copy of the usual plumage of the female.

Cases of partial albinism are not infrequent in this species. The several examples in the Academy's series show white feathers among the colored ones at the base of the neck and on the breast.

A number of specimens have a distinct rusty wash on the tips of the feathers of the breast and abdomen.

The females average somewhat smaller than the males, as shown by the following extremes and averages in millimeters, which are condensed from the measurements of forty-five males and thirty-five females, all from the Galapagos Islands: Males—Wing 190–215 (203); tail 72–94 (83); culmen 40–45 (43); tarsus 31.1–36 (33.1); middle toe 37.5–43.9 (40.4). Females—Wing 180–202 (192); tail 67–81 (72); culmen 37–43.4 (40.1); tarsus 29–33.7 (31.3); middle toe 36–40.5 (38.1).

The single egg of this species taken on Charles Island measures 51×35.1 mm.

### Querquedula versicolor: Brilliant Teal

In a nominal list of the Galapagos birds brought home by the Swedish Frigate "Eugenie," Professor Carl J. Sundevall includes *"Anas maculirostris."*[1] The "Eugenie," while on a voyage round the world, visited the islands in May, 1852, with Dr. Kinberg as zoologist and surgeon of the expedition.

There is apparently no other record of this species from the Galapagos Islands.

### Querquedula discors: Blue-winged Teal

Albemarle and Chatham islands.

The presence of the Blue-winged Teal in the Galapagos Islands was first detected on February 8, 1906, by Mr. Beck, who saw nine in the company of a flock of Bahama Pintails in a pond above sixteen hundred feet elevation on Chatham.

[1] P. Z. S., 1871, p. 126.

They were quite wild, and flew upon close approach, while the native ducks remained.

Three were next seen by Mr. Hunter on March 6, as they were flying about the large salt lagoon near Villamil, Albemarle Island. On August 22 a male and a female were seen three or four times during the forenoon in that locality. They were very wary, however, and always kept out of shot-gun range. The next day a very long wing-shot brought down a drake. A little later in the day half a dozen were found feeding in a lagoon about half a mile from the sea, and a second bird was shot, but lost in a mangrove thicket. The people at Villamil readily distinguished this species from the Bahama Pintail, and had a name for each. They said that the Blue-winged Teal occurred there regularly every year.

The drake (No. 2336 C. A. S.) taken on August 23 was in practically full plumage, including new primaries. The rectrices and many of the feathers of the abdomen, however, were old and worn.

On August 10, 1905, a wing-tipped female Shoveller (*Spatula clypeata*), No. 2337 C. A. S., was shot in the brackish lagoon of Clipperton Island, Mexico. The specimen was in moult, new feathers appearing in the breast, abdomen, crissum, rump, and back. The primaries had not been moulted.

According to Mr. Beck, ducks occur in considerable numbers at Clipperton Island during the northern winter. He visited the island on November 19, 1901. "Several hundred ducks were seen, the majority being of the following species: *Dafila acuta* (Pintail); *Mareca Americana* (Bald pate); *Querquedula discors* (Blue-winged Teal); *Spatula clypeata* (Shoveller); and a single *Fuligula vallisneria* (Canvasback)." He also reports seeing two specimens of *Fulica americana*. On Cocos Island, Costa Rica, on January 26, 1902, he shot one *Querquedula discors* and saw two more.[1]

### **Nannopterum harrisi**: FLIGHTLESS CORMORANT

Plate IV

Albemarle and Narborough islands.

With a more restricted range than any other water-bird in the archipelago, the Flightless Cormorant frequents the coast

[1]Condor, v. 9, p. 110.

of Narborough Island and the adjacent coast of western Albemarle. We saw it commonly about the east coast of the former island, and at Banks Bay on the latter. At Tagus Cove two were seen, one on April 7 and the other on April 19. We never saw as many together at one time as we did of the penguins at Iguana Cove, the limit being less than a dozen. The extreme lack of wariness of these birds will probably cause their total extinction when man more commonly frequents this portion of the archipelago. Their small numbers and their much restricted habitat would seem to indicate that they are on the verge of extinction.

As the name denotes, these creatures are flightless; and we never observed them attempt to fly even when hard pressed. While sitting in their usual upright position, the wings are often held half spread and away from the body, as shown in plate 10, volume 9 of *Novitates Zoologicae.*

They are expert swimmers and divers. In diving, the bird acts differently from the Galapagos Penguin; for instead of merely submerging itself like a seal, it makes a sort of jump, throwing its head and neck forward at the same time, disappearing head first. One bird, when finally driven from its nest, swam under water very swiftly for fifty feet or more.

When it comes to progression on land, however, they are not so agile, their large bodies and short legs greatly impeding their progress. On level ground they waddle, but where rocks or other obstacles are in the way, they proceed by short jumps, keeping in an upright position all the time. They were seen to jump up on rocks six or seven inches high, but sometimes had to make two or three trials before getting over difficult places. Upon leaving the water they always stood and shook themselves. It was not uncommon to see several sitting upon some black lava-point or islet, usually near their nests.

On land they were easy of approach, and one could usually walk up to them and kill them with a stick. On the water they were warier, but were usually approached within shotgun range. We observed none in the surf as reported by other visitors, for the simple reason that there was no surf at the time of our visits.

Their weapon of defense is the bill, which they can use very effectively. One bit a member of our party on the breast, cutting through his shirt and drawing considerable blood. A number were carried alive in sacks from Narborough to Tagus Cove. Holes were cut in the sacks, allowing their heads and necks to protrude; each sack became a veritable Hydra. When they were not biting each other in their rage, they were making vicious passes at us with their long snake-like necks. At the nest, both birds were usually loyal to each other, and put up a good fight against the intruder. Once or twice the mate of a bird at the nest was observed to come out of the water and climb laboriously up to its nest, and, finding an enemy there, valiantly help to defend it.

These cormorants were seen swallowing fish upon coming to the surface after a dive. An eel fourteen inches long was taken from the gullet of one bird.

In sleeping, they throw the body forward slightly from the usual upright position, and place the head and neck over the shoulder, thrusting the bill down the side of the body under the secondaries. One of the most ridiculous sights I saw in the Galapagos Islands was one of these clumsy creatures scratching its head. Balancing itself on one foot, it carefully lowered its head so that it could reach it with its free foot, and proceeded very solemnly to scratch for perhaps half a minute.

When on a visit to southeastern Narborough on March 22, a bird was observed pursuing another about a small tidal lagoon. Perhaps this was a case, similar to that mentioned by Messrs. Snodgrass and Heller,[1] of a young bird pursuing an adult for food, although in this instance it was not successful. They were heard to utter two or three harsh croaking notes.

On April 16th at Banks Bay, several were seen, and two pairs were found with nests without eggs situated at an elevation of about ten feet in a sandy place just back of the black lava of the shore. There were three nests about three feet apart, one an old one, and all placed close to a small cactus. A fourth was seen some fifty yards away, also in the sand. The nests with birds at hand were mere depres-

[1]Proc. Wash. Acad. Sci., v. 5, p. 250.

sions in the sand, lined around the edges with a few sticks and seaweed, some of which was fresh. The owners held their ground resolutely, opening their mouths at us menacingly and uttering harsh guttural croaks. The voices of both males and females seemed to be alike.

On northeastern Narborough on April 17, 18, and 19, two colonies were found nesting—three pairs in one colony, and four or five in the other. In the first colony, two sets of three eggs each were taken; and in the second, one set of two. In each set there were one or two fresh eggs, and one or two with incubation begun. The nests were of sticks and seaweed, mostly fresh, and were placed on the bare black lava about ten feet above the water. In both instances the nesting-place seemed also to be the haunt of sea iguanas. The nests were five or six inches high at the rim, with a depression an inch deep in the center.

Parasitic worms were found in the alimentary tracts of several birds.

The colors of the naked parts of breeding adults were as follows: Iris bluish green; feet black; lower mandible drab-gray; upper mandible slate-color, drab-gray at tip; gular sac drab-gray, with whitish dots; lores dusky with parallel longitudinal ridges of pale dots.

All of the Academy's skins, which were taken in March and April, are in fresh body-plumage, and many—particularly birds taken in March—show pin-feathers and newly expanded feathers. The wings and tails of all are more or less worn, and in almost every case new rectrices are appearing; new remiges, however, are not so common. With one exception, all of the specimens have filoplumes on the sides of the head, and similar white filoplumes are to be found hidden among the body feathers, particularly those of the under parts.

One specimen was found with a white feather in the tibia, another with one in the back, and still another with two in the back.

A dark-brown specimen, No. 2358, without filoplumes, was taken on Narborough on March 22. The middle rectrices are fresh, the others much worn. The wings are also worn, but the body-plumage has been pretty well renewed. The old feathers still remaining in the breast are very soft and downy.

In fact the whole plumage of the under parts is softer than that of adult birds.

MEASUREMENTS (in millimeters)

| Number | Sex | Length | Extent | Wing | Tail | Culmen | Tarsus | Outer Toe |
|---|---|---|---|---|---|---|---|---|
| 2354 | ♂ | | | 185 | 145 | 75 | 65 | 105 |
| 2355 | ♂ | | | 192 | 144 | 83 | 68 | 112 |
| 2356 | ♂ | | | 190 | 146 | 80 | 66 | 111 |
| 2357 | ♂ | | | 201 | 160 | 79 | 70 | 110 |
| 2358 | ♂ | | | 196 | 147 | 77 | 65 | 101 |
| 2360 | ♂ | | | 190 | 142 | 78 | 65 | 107 |
| 2364 | ♂ | | | 189 | 145 | 82 | 65 | 115 |
| 2365 | ♂ | | | 198 | 160 | 90 | 67 | 115 |
| 2368 | ♂ | | | 200 | 150 | 89 | 68 | 115 |
| 2369 | ♂ | | | 193 | 156 | 77 | 65 | 115 |
| 2373 | ♂ | 1000 | 840 | 192 | 140 | 80 | 68 | 110 |
| 2376 | ♂ | | | 197 | 147 | 83 | 65 | 104 |
| 2378 | ♂ | | | 186 | 156 | 85 | 72 | 112 |
| 2359 | ♀ | | | 188 | 149 | 76 | 59 | 101 |
| 2361 | ♀ | | | 175 | 142 | 75 | 55 | 95 |
| 2362 | ♀ | | | 181 | 142 | 82 | 57 | 97 |
| 2363 | ♀ | | | 176 | 145 | 73 | 56 | 97 |
| 2366 | ♀ | | | 177 | 144 | 75 | 61 | 98 |
| 2367 | ♀ | | | 176 | 145 | 73 | 58 | 102 |
| 2370 | ♀ | | | 180 | 139 | 75 | 60 | 101 |
| 2371 | ♀ | | | 178 | 138 | 76 | 60 | 99 |
| 2374 | ♀ | 830 | 730 | 178 | 140 | 69 | 57 | 97 |
| 2375 | ♀ | | | 187 | 147 | 80 | 65 | 103 |
| 2377 | ♀ | | | 176 | 147 | 76 | 57 | 97 |
| 2379 | ♀ | | | 182 | 145 | 77 | 60 | 103 |
| 2380 | ♀ | 910 | 735 | 196 | 156 | 73 | 61 | 98 |
| Average | ♂ | | | 193 | 149 | 81 | 67 | 110 |
| Average | ♀ | | | 181 | 145 | 75 | 59 | 99 |

The three sets of eggs taken by the Expedition measure in millimeters as follows: 64×39, 66×40.5, 69×41; 59.5×40.5, 63×44, 65×44; 69×42, 70×42.

### **Sula cyanops**: Blue-faced Booby

The Blue-faced Booby is one of the common boobies of the eastern tropical Pacific north of the Galapagos Islands. The Academy's expedition first encountered it on July 23, 1905, in latitude 20° 59′ North, longitude 111° 57′ West. The last one noted on the southward voyage was seen on August 18 in latitude 7° 24′ North, longitude 103° 52′ West. During a stiff blow off Clipperton Island, Mexico, I noted an immature one on the water exhausted.

At San Benedicto, Revilla Gigedo Islands, the species was common and nesting on July 26, 1905, eggs and naked young being seen. At Clipperton Island on August 10, there were large colonies scattered about among the Brewster's Boobies, but none were nesting.

On the northward voyage the species was first noted on September 29, 1906, in latitude 9° 22′ North, longitude 98° 25′ West, when half a dozen immature birds with brown heads were seen singly during the day. Individuals of this species, usually immature, were seen almost daily until October 25, latitude 19° 53′ North, longitude 118° 1′ West.

Life-colors of naked parts of brown-headed immature birds are: Bill olive-buff; gular sac and face dark plumbeous with light spot under eye; feet cinereous with toes olive-buff on under side.

Life-colors of naked parts of adults: Bill straw-yellow; gular sac and face bluish black with light spot under eye; feet lavender, toes edged with olive-buff.

In the following table are the measurements of thirteen adults taken by the Expedition.

MEASUREMENTS (in millimeters)

| Number | Sex | Locality | Wing | Tail | Culmen | Tarsus | Middle Toe |
|---|---|---|---|---|---|---|---|
| 2381 | ♂ | 10° 20′ N., 108° 44′ W. | 423 | | 106 | 54 | 77 |
| 2383 | ♂ | Vicinity of Clipperton | | 170 | 99 | 52 | 73 |
| 2384 | ♂ | Vicinity of Clipperton | | | 106 | 54 | 76 |
| 2385 | ♂ | Vicinity of Clipperton | 426 | 177 | 102 | 55 | 77 |
| 2387 | ♂ | 10° 20′ N., 109° W. | 418 | 176 | 103 | 54 | 78 |
| 2388 | ♂ | Vicinity of Clipperton | | 176 | 100 | 51 | 73 |
| 2398 | ♂ | Vicinity of Clipperton | 414 | 178 | 102 | 54 | 76 |
| 2382 | ♀ | 10° 20′ N., 109° W. | 428 | 176 | 100 | 54 | 75 |
| 2386 | ♀ | 19° 37′ N., 111° 11′ W. | 440 | 181 | 100 | 57 | 79 |
| 2389 | ♀ | Vicinity of Clipperton | | 180 | 104 | 53 | 80 |
| 2390 | ♀ | 13° 28′ N., 108° 52′ W. | | 173 | 103 | 54 | 77 |
| 2391 | ♀ | 10° 20′ N., 108° 44′ W. | | 185 | 106 | 57 | 79 |
| 2392 | ♀ | Vicinity of Clipperton | 428 | 187 | 103 | 57 | 79 |

### **Sula piscatrix**: Red-footed Booby

Plate V, Fig. 1

Abingdon, Bindloe, Culpepper, Gardner-near-Charles, Hood, Indefatigable, Tower, and Wenman islands.

This booby, the boldest and most inquisitive of the five species met with on the Expedition, was found commonly at Culpepper, Tower, and Wenman islands. One example was observed close to Gardner-near-Charles on October 3, 1905, and one near South Abingdon on September 22, 1906. On September 14, 1906, I noted two about twenty miles south of Tower Island. None were encountered at Hood Island, where Messrs. Snodgrass and Heller found them nesting in May.[1] One in the dark phase was seen south of the archipelago on June 15, in latitude 2° 17′ South, longitude 90° 58′ West. Most of the birds seen in the Galapagos Islands were in the dark phase, although a number in the light phase were noted at Culpepper, Tower, and Wenman islands—chiefly at Culpepper. Birds in all sorts of pied or intermediate stages were observed. At Cocos Island, Costa Rica, birds in the light phase or in pied stages were very rare, even more so than in the Galapagos Islands.

In 1905 the northernmost locality in which we saw the Red-footed Booby was latitude 20° 59′ North, longitude 111° 57′ West, on July 23. This was in the general vicinity of San Benedicto, Revilla Gigedo Islands, where the light phase of the species occurs commonly. After leaving San Benedicto the species was next met with in latitude 5° 43′ North, longitude 98° 44′ West, on August 23, when a bird in the dark phase was seen. Another was seen on the 24th, one on the 28th, and two on the 31st. On September 1st, when in the vicinage of Cocos Island, they became common; all were in the dark phase.

In 1906, from the time we left Culpepper Island on September 25, until we were in latitude 19° North, longitude 116° 41′ West, on October 24, Red-footed Boobies were seen daily with but two exceptions. The first individual in the light phase was seen on October 7, in latitude 14° 38′ North, longitude 109° 12′ West, after which they were seen with more or less frequency, particularly in the vicinity of Clarion Island, Revilla Gigedo group. Judging from the dull colors of the naked parts, practically all of the birds of the dark phase seen after leaving the Galapagos group were immature. An occasional immature bird with pale under parts was encountered.

[1]Proc. Wash. Acad. Sci., v. 5, p. 247.

At Tower, Wenman, and Culpepper islands, Red-footed Boobies were sitting in the bushes and low trees both singly and in pairs. In one or two cases a white adult was seen in company with a gray adult. The nests were composed of loose sticks placed in a bush or low tree. On Tower Island, the nests were found all over the island, and two or three fresh eggs were seen on September 15. Only an occasional bird, however, was found on a nest. On Wenman Island, on September 24, the majority of the birds seemed to have no nests, but were simply sitting about in the trees and bushes. No eggs were discovered. A young bird just able to fly was taken on Wenman, and one was seen on Tower.

Three females taken forty miles south of Cocos Island on September 2, 1905, had large ovaries. At Cocos, the birds were very common on the wing and in the trees growing along the rocky precipitous shores. In the forest I noticed several breaking off twigs for nests. On September 13 Mr. Beck took a fresh egg from a nest in a small tree on a rocky island occupied by a nesting colony of Brewster's Boobies.

When a bird alighted at its nest or beside its mate, it craned its neck and, swinging its head from side to side, uttered a long, harsh, cackling call consisting of a short guttural note repeated fifteen or twenty times in quick succession. This call resembled somewhat the call given by the Man-o'-war Bird when on the nest, only that it was harsher. At Cocos Island the birds in the trees kept up a continual loud cackling noise.

When these boobies were asleep or pluming themselves in some tree, a person could walk right up to them before being noticed. They usually straightened up with a startled expression, often uttering a short squawk of surprise. If one continued to disturb them they would squawk vociferously and try to fly away, frequently floundering about among the branches.

The flight of the Red-footed Booby is more graceful than that of the Blue-faced and the Peruvian, and somewhat resembles that of a large shearwater. When in the vicinity of Cocos Island and of Clarion Island, flocks of Red-footed Boobies were seen flying away from the islands in the morning and towards them in the evening. The flocks contained from six to fifteen birds. The birds fly with the same gentle, wave-like

rise and fall that characterizes the flight of other members of this genus. The wing-strokes occur on the rise; on the downward swing the bird sails, in calm weather often going several yards very close to the surface of the water. The members of a flock are practically synchronous in every action.

In fishing, the Red-footed Booby pursues the same tactics as the Blue-footed, diving, with wings half closed and rigid, from a height of twenty or thirty feet. On one occasion, however, I saw one catching flying-fish on the wing by swooping into schools which were skimming along above the water.

Over half of the Academy's series of fifty-eight skins is made up of adult birds. Some of these, in the dark phase, show new dusky feathers replacing old, faded, dusky feathers.

In No. 2440 (male, dark phase, from Cocos), the bill has dried of a bright-red color. This bird has the black gular sac and is evidently adult. In most cases the bill dries mainly of a dusky bluish black.

The colors of the naked parts of a freshly-killed adult dark-phase bird were as follows: Bill pale blue, except at base, where it was peach-blossom pink; skin around eyes azure blue; gular sac black; feet poppy-red.

The colors of the naked parts of a freshly-killed brown-plumaged immature bird were as follows: Bill brownish with pinkish blotches near base; skin around eyes dark blue; gular sac French-gray, blackish at posterior edge; feet dull pinkish with dirty bluish shade in webs.

The colors of the naked parts of a freshly-killed immature bird with pale under parts were as follows: Bill pale bluish and pinkish with dark tip; skin around eyes blue; gular sac pale blue with black along sides next the mandibular rami; feet pinkish vinaceous.

The single egg taken at Cocos Island measures 58.7 mm. × 40.8 mm. It is dull chalky white in color.

MEASUREMENTS OF ADULTS (in millimeters)

| Number | Sex | Locality | Phase | Wing | Tail | Culmen | Tarsus | Middle Toe |
|---|---|---|---|---|---|---|---|---|
| 2408 | ♂ | Revilla Gigedo | Light | 413 | 224 | 86.7 | 35 | 63 |
| 2411 | ♂ | Revilla Gigedo | Light | 406 | 219 | 85.1 | 34.2 | 59 |
| 2429 | ♂ | Cocos | Dark | 404 | 232 | 88.8 | 33.1 | 61 |
| 2430 | ♂ | Cocos | Dark | 395 | 205 | 87.1 | 33.1 | 61 |
| 2433 | ♂ | Cocos | Dark | 390 | 216 | 82.9 | 32 | 58 |
| 2434 | ♂ | Cocos | Dark | 388 | 230 | 87.7 | 31.1 | 61 |
| 2448 | ♂ | Cocos | Dark | 398 | 218 | 90 | 33.4 | 60.6 |
| 2414 | ♂ | Galapagos | Pied | 381 | 192 | 87.9 | 31.4 | 57 |
| 2415 | ♂ | Galapagos | Pied | 414 | 230 | 91.7 | 33 | 62.6 |
| 2416 | ♂ | Galapagos | Pied | 404 | 207 | 91 | 37.1 | 61 |
| 2432 | ♂ | Galapagos | Dark | 422 | 217 | 88 | 36 | 64 |
| 2437 | ♂ | Galapagos | Dark | 395 | 214 | 87.8 | 35.1 | 63.5 |
| 2441 | ♂ | Galapagos | Dark | 395 | 217 | 88.3 | 34.1 | 61.8 |
| 2445 | ♂ | Galapagos | Dark | 399 | 191 | 89 | 33.3 | 60.5 |
| 2449 | ♂ | Galapagos | Dark | 390 | 214 | 84.4 | 32 | 58 |
| 2409 | ♀ | Revilla Gigedo | Light | 411 | 213 | 90.2 | 35 | 65.6 |
| 2410 | ♀ | Revilla Gigedo | Light | 385 | 216 | 90 | 32.7 | 61 |
| 2422 | ♀ | Cocos | Dark | 411 | 212 | 91.3 | 37 | 65.1 |
| 2425 | ♀ | Cocos | Dark | 395 | 215 | 82.5 | 32.3 | 60.7 |
| 2428 | ♀ | Cocos | Dark | 412 | 214 | 87.4 | 35 | 63.1 |
| 2431 | ♀ | Cocos | Dark | 418 | 223 | 94.2 | 35 | 61 |
| 2438 | ♀ | Cocos | Dark | 391 | 214 | 87.3 | 34 | 61.4 |
| 2420 | ♀ | Galapagos | Pied | 390 | 195 | 88.7 | 35 | 59.6 |
| 2421 | ♀ | Galapagos | Dark | 419 | 212 | 92 | 33 | 60 |
| 2423 | ♀ | Galapagos | Pied | 399 | 212 | 84 | 33.7 | 60.8 |
| 2426 | ♀ | Galapagos | Dark | 402 | 212 | 84.5 | 32 | 57.8 |
| 2427 | ♀ | Galapagos | Pied | 412 | 198 | 90.5 | 38.9 | 63.1 |
| 2435 | ♀ | Galapagos | Dark | 410 | 215 | 92.7 | 33 | 60 |
| 2436 | ♀ | Galapagos | Dark | 397 | 205 | 93.1 | 34.4 | 61.9 |
| 2439 | ♀ | Galapagos | Dark | 408 | 211 | 86 | 31.9 | 60.9 |
| 2443 | ♀ | Galapagos | Dark | 385 | 199 | 86.5 | 32.7 | 62 |

### **Sula variegata**: PERUVIAN BOOBY

Abingdon, Albemarle, Barrington, Bindloe, Brattle, Champion, Charles, Chatham, Cowley, Crossman, Culpepper, Daphne, Duncan, Enderby, Gardner-near-Charles, Gardner-near-Hood, Hood, Indefatigable, islet off northeast James. James, Nameless, Narborough, Seymour, Tower, and Wenman islands.

This booby was found pretty commonly throughout the archipelago, and chiefly about the islands on which it bred. It frequented the open sea rather than the sheltered bays, differing in this respect from the Blue-footed Booby. The farthest south we saw it was latitude 3° 39′ South, longitude 93° 1′ West. Off the coast of Colombia and Ecuador, we

saw on two occasions a large white booby, which we took to be this species. The day after leaving Culpepper Island, September 26, 1906, we saw one in latitude 3° 29′ North, longitude 93° 6′ West; while on October 13, 1906, a nearly adult bird was taken in latitude 15° 36′ North, longitude 110° 12′ West. Mr. Beck records two at Clipperton Island, Mexico, and two at Cocos Island, Costa Rica.[1]

The breeding-places and breeding-dates for this species in the Galapagos Islands, so far as known are as follows: Culpepper in July and December; Daphne in November; Enderby in May; Gardner-near-Charles in October; Hood in February, May, and October; Wenman in February and December.

The nest was a mere depression in the soil, usually surrounded with pebbles and bits of rock, and invariably situated close to the sea, often on the edge of some precipice or on a ledge of a cliff. A sitting bird was frequently seen picking up bits of rock with its bill and placing them around the nest. When both male and female were at a nest they had the habit of touching bills.

Whenever a bird was driven from a nest, it left with great reluctance, and usually returned in a minute or two with much squawking, and fondly covered its charge. When the mate arrived to relieve the nest bird, there was also a great deal of squawking. One day I was sitting in front of a nest when the second owner arrived. The nest bird immediately drew its attention to me, and apparently tried to induce it to join in an attack on me.

The first place in which we encountered Peruvian Boobies breeding, was the larger Daphne Island, where they were nesting on the steep seaward slopes and on the rim of the crater, but not within the crater itself, which was occupied by Blue-footed Boobies. On November 23 some had eggs, and others had young.

They were nesting abundantly on Hood Island in early February. On February 1st some birds were seen with fresh eggs, some with one egg and one young, others with two very young ones, and others still with one young one only. All of the young were either naked or in the down. The adults seem, however, to rear only one young one, for I have never seen

[1]Condor, v. 9, p. 110.

more than one in a nest when they approach the feathered stage. The great difference in size between the two nestlings in the same nest is particularly noticeable as their age increases; one is small and puny, the other robust and strong. When we visited Hood Island again in latter June, there were a number of young about, which still had some down on them.

A young bird in down was taken on Enderby on May 14. Its bill and feet were olive-gray.

On one occasion Mr. Beck saw an adult Peruvian Booby taking care of a downy Man-o'-war Bird in a nest of the latter species.

Unless continually persecuted, these boobies exhibit practically no fear of man. The young particularly show considerable curiosity. Just south of Hood Island, on June 23, we encountered large numbers of them, many of which kept alighting within two or three feet of the schooner. Fifty or sixty were seen on the water intermingled with as many Dusky Shearwaters.

On Hood Island, Peruvian Boobies were to be seen sprinkled about among the Man-o'-war Birds, Blue-footed Boobies, and Galapagos Albatrosses, which had nesting-sites close to the cliffs. When asleep at the nest, these boobies thrust the bill down the middle of the back under the feathers.

Apparently the boobies are bothered somewhat by the Galapagos Hawks, for I noticed an adult booby, with a young one in the nest, show considerable alarm when a hawk alighted on a rock close by. In defence against human intruders, the boobies use their bills with telling effect.

During March, when on the south coast of Albemarle Island, Peruvian Boobies were noted each evening flying toward Brattle Island. The flight was not particularly swift or graceful. Several slow wing-beats were succeeded by a long sail. Single birds usually flew somewhat higher than the flocks. When three or four were together they kept time in all their movements, usually following a leader, sometimes one behind another, sometimes bunched. One was observed following a Blue-footed Booby in a similar manner. At sea they not infrequently circled about the vessel. On land they waddle, usually with the tail scraping the ground.

I have never seen the adults dive, but I once saw an immature bird do so. It shot obliquely into the water from a distance of only a few feet, entering at a very small angle and making a semicircle while in the water. It came up facing in the direction just opposite to that in which it entered. One day I saw one sitting on the water with head immersed for a long time, and apparently looking for food. Fish seem to constitute their chief diet. Once I saw a Peruvian Booby attack a wounded Blue-footed Booby and force it to disgorge. On another occasion I saw one catch a flying-fish by skimming close over the water after it.

The colors of the naked parts of the adults in life were as follows: Bill vinaceous-pink, shading into ochre-yellow at tip and along tomia; gular sac slate-gray; iris gamboge-yellow; feet dark olive-buff.

An immature bird shot at Cormorant Bay, Charles Island, on May 17, had an olive-buff bill; the gular sac and feet were of about the same color as those of adults. Gular sacs of young in down were flesh-colored. In fully fledged young they were dark blue or blackish blue.

Although the Academy's series of skins of this species numbers sixty-nine, and is well supplied with birds both in juvenal plumage and in adult plumage, specimens are lacking to show the complete transition from juvenal to adult. One specimen, No. 2478, taken on October 12, 1906, in latitude 15° 40′ North, longitude 110° 12′ West, is apparently just completing the assumption of the adult plumage, for a number of partially dusky feathers are still to be seen in the upper parts.

An examination of the adult males in the collection revealed birds with new outer primaries appearing, as follows: From Hood Island in June and October; from Culpepper in September. Only one female (No. 2510) was found in a like condition—an individual taken on Hood on October 2. In most cases the males seemed to be somewhat in advance of the females in the progress of the moult.

In conjunction with the measurements of twenty-three adult males and twenty-five adult females, there are given for the sake of comparison, in Table XI, p. 117, the measurements of seven adult males and six adult females of *Sula cyanops*. The average *Sula variegata* has a decidedly longer wing, and has

a relatively shorter tarsus in comparison with the middle toe, than has the average *Sula cyanops*. Males seem to average decidedly smaller than females in most respects.

Fifteen eggs of the Peruvian Booby, taken by Mr. Beck on Hood Island on February 4, yield the following maximum, minimum, and average measurements in millimeters: Length 55–68.4 (63.5); breadth 38.6–49.5 (44.8). These fifteen eggs comprise eleven sets, four of two eggs each and seven of one each. The sets of two eggs each measure as follows: 61.6×44.5, 62.5×46; 65.5×45.6, 55×38.6; 62.8×46, 65×46.6; 62.6×45.8, 61.7×44.7. On several of the data-sheets Mr. Beck states that the nest had been occupied four months before by Neboux's Booby (*Sula nebouxi*).

In addition to eggs of *Sula variegata* from Hood Island, Mr. Oates has referred a number of eggs of *Sula cyanops* from San Benedicto and Clarion, Revilla Gigedo Islands, to this species.[1]

### Sula nebouxi: Blue-footed Booby

Plate V, Fig. 2

Abingdon, Albemarle, Barrington, Bindloe, Brattle, Champion, Charles, Chatham, Cowley, Crossman, Daphne, Duncan, Enderby, Gardner-near-Charles, Gardner-near-Hood, Hood, Indefatigable, islet off northeast James, James, Jervis, Kicker, Narborough, Onslow, Seymour, Tower, and Wenman islands.

The Blue-footed Booby was by far the commonest and most generally distributed of the three species occurring in Galapagos waters. Like the Dusky Shearwater, the Graceful Petrel, and the Sooty Gull, it seemed to prefer to be in close proximity to the land, rather than to haunt the open ocean as do the Red-footed and the Peruvian Boobies. Except for a single specimen taken at the San Benito Islands, Baja California, on July 15, 1905, we saw no Blue-footed Boobies outside of the archipelago.

When not fishing, the Blue-footed Boobies frequently congregated on the low black lava-points which jut into the sea, the assemblages varying from two or three to thirty or forty, Single birds and pairs are often seen standing on the ledges

[1]Cat. Coll. Birds' Eggs Brit. Mus., v. 2, p. 211.

and on the tops of sea-cliffs. On south James they were seen in the mangroves. It was not unusual to find them asleep in broad daylight. An entire flock, however, was never caught napping, two or three birds always being awake and on the lookout.

When offshore and on a journey, the Blue-footed Boobies frequently flew in single file, all following the undulations of the leader. On the south coast of Albemarle Island, in May, they were noted flying towards Brattle Island each evening. Single birds met with offshore usually circled about the schooner. The birds noted about the bays and coves had the habit of continually looking downward when flying, apparently in search of fish.

The fish were almost invariably caught by diving, although an occasional flying-fish was chased and caught while in the air. It was a common thing to see Blue-footed Boobies fishing in flocks, often all diving simultaneously. They dive with wings half-closed and neck rigid and straight, striking the water with great force. As all would not get fish when diving in a flock, there was usually considerable squabbling over captures. One day a booby was seen to enter the water obliquely at a very small angle, appearing quickly on the surface again and continuing its line of flight without a pause.

At Finger Point, Chatham Island, in the middle of February, there were several Blue-footed Boobies standing about in the vicinity of some old nests three or four hundred feet above the ocean. Whenever a bird alighted, there was a great deal of squawking and bowing and waddling carried on by it and its mate. In latter March during the mating-season at Tagus Cove, Albemarle Island, they were quite demonstrative, the mated birds seeming to talk to each other, and managing to keep up an incessant racket. One of them as a rule did considerable strutting about, lifting its feet very high with each step, and appearing to us very ridiculous. They made a very elaborate bow, uttering one or two short notes at the same time. With the breast almost touching the ground, the neck stretched upwards, and the wings outspread but held vertically, the ceremony of bowing would last for about half a minute.[1]

[1]Cf. Beck, Condor, v. 6, pp. 6-8.

The nest of this species was like that of the Peruvian Booby, a mere depression in the earth in which two eggs were laid. On Hood and Champion Islands Blue-footed Boobies nested in the vicinity of the shore, sometimes along the tops of cliffs, at other times close to the water. The birds at Hood Island in September, 1905, were nesting beside white glazed rocks and in the broiling sun, with no shelter whatsoever. Many of them were sitting on their nests with mouth open, panting with heat and thirst. On Daphne they nested on the sandy floor of the crater, which is three or four hundred feet deep and very hot, as it is protected on all sides from the wind. Only one pair was seen nesting outside the crater. At Tagus Cove they nested on the broad ledges and tops of the low tufaceous cliffs.

The following notes on the time and place of breeding of the Blue-footed Booby, taken in conjunction with the observations of other expeditions, point to an almost continuous breeding-season. We found eggs, young in the down, and fully fledged young at Hood Island, in September and October; both naked young and young assuming juvenal plumage at Hood in February; eggs, birds in down, and well-feathered young at Champion in October; young in the down at Champion in February; naked young at Brattle in October; eggs and downy young at Daphne in November; large young of various ages at Daphne in July; fresh eggs at Tagus Cove in March; and one large young one at Tower in September. There are two young hatched; but by the time they reach the partially-feathered state, seldom more than one has survived.

The half-fledged young exhibited considerable pugnacity. When one was shoved into a neighbor's domain, a fight ensued, the birds seizing each other by the beak and then having a tug-of-war for perhaps a minute.

An adult taken at Academy Bay, Indefatigable, had its right foot deformed. At the junction of the toes with the tarsus the foot was enlarged and immovable, the toes were bent under and altogether rigid, and one claw was much elongated.

Breeding adults taken at Tagus Cove had the following life-colors: Feet pale blue; bill plumbeous; gular sac china-blue.

The juvenal plumage of *Sula nebouxi* at first glance resembles somewhat that of *Sula variegata,* but is readily distinguished from it by the narrow feathers of the neck, as well as by the pale brown of the upper breast. The specimen mentioned by Messrs. Rothschild and Hartert in their first Galapagos paper as "probably not in the first plumage, but in a transitional one,"[1] is evidently a bird in juvenal ("first") plumage. In the Academy's series there are a number of specimens passing from the down into this plumage.

In their second paper these gentlemen seem to have been more seriously misled, for the description they give for the "first" (juvenal) plumage of *Sula nebouxi* fits the young of *Sula variegata* and not the young of *Sula nebouxi.* "These birds in the first plumage differ from the adult ones in having the feathers of the head and neck (which in adult birds are narrow and pointed, giving these parts a streaked white-and-brown appearance) shorter, soft, wide and rounded, and of a uniform deep smoke-brown colour, so that the neck is in a striking contrast to the white breast and abdomen."[2] Every point here given fits *Sula variegata* rather than *Sula nebouxi.* The young of *Sula nebouxi* have the upper breast pale brown and "the whole neck smoky brown, with paler tips to the feathers,"[3] which are long and narrow. There is not the striking contrast between the neck and the upper breast as in *Sula variegata.*

Again, in their second paper, Messrs. Rothschild and Hartert state that in the "first" plumage of *Sula nebouxi* "the white interscapular saddle, which is so conspicuous in adult *S. nebouxi,* is not developed." In every one of a series of thirteen Academy specimens—some partly in the down, others in full juvenal plumage—the white interscapular saddle is more or less conspicuous, being even more noticeable than in adults on account of the sharper contrast of colors. The young of *Sula variegata* lack this saddle.

In the Academy's series of adults, three have the outer primaries in a pulpy state basally: No. 2543, a male taken at Duncan Island on December 9; No. 2570, a female taken at Duncan on December 14; No. 2579, a female taken at In-

[1]Nov. Zool., v. 6, pp. 178, 179.
[2]*Ibid.,* v. 9, p. 407.
[3]*Ibid.,* v. 6, pp. 178, 179.

defatigable on July 18. Inasmuch as the breeding-season extends practically throughout the year, the various plumages do likewise.

The measurements given below of twenty adult males and twenty-seven adult females reveal the fact that on the average the female is somewhat superior to the male in size. The measurements of length of tail are not very dependable, for the central tail-feathers in this species are very long and hence suffer much from wear. The maximum, minimum, and average dimensions in millimeters are: Males—Wing 412–460 (433); tail 200–239 (222); culmen 101–118 (108); tarsus 47–55 (50); middle toe 64.9–78 (70). Females—Wing 428–465 (447); tail 207–250 (227); culmen 110.6–121 (115.4); tarsus 51–57 (53.7); middle toe 69.4–81 (74.2).

The eggs of *Sula nebouxi,* like those of other boobies, have a very pale bluish ground-color over which there is a chalky-white coating. One specimen lacks this coating, and is a pale blue all over. The other egg in the same clutch has the coating.

Seventeen eggs (ten of them composing five sets of two each, the remaining seven composing seven sets) collected by Mr. Beck from a colony on southeast Hood on September 28, 1905, yield the following minimum, maximum, and average dimensions in millimeters: Length 57.6–67.7 (62.3); breadth 40.2–45.4 (43.1). The eggs comprising the sets of two each measured by sets: 64.5×41.1, 63×42.9; 61.4×43.6, 63.5×44.5; 63.5×43.5, 61.6×42.6; 57.6×42, 59×40.2; 61.9×43.6, 61×43.9.

### Sula brewsteri: Brewster's Booby

It is not unlikely that the birds reported from the Galapagos Archipelago as Brewster's Boobies were either the young of the Peruvian Booby or the young of the Blue-footed Booby.

The three centers of abundance of Brewster's Booby visited by the Galapagos Expedition were San Benedicto, Revilla Gigedo Islands, on July 26; Clipperton Island, Mexico, on August 10; and Cocos Island, Costa Rica, September 3-13, 1905.

We first encountered Brewster's Boobies on July 24, latitude 19° 40′ North, longitude 112° West. They were com-

mon, especially toward evening, when they passed in flocks of ten or more. One came aboard the schooner after dark and was captured. At San Benedicto they were fairly common. Two nests were found; on one a male was brooding a young bird; on the other a female was brooding two eggs.

A number of Brewster's Boobies were observed daily on the voyage from San Benedicto to Clipperton Island. There appeared to be no decrease in numbers to indicate where the birds from one colony ended and those from the other began. In the vicinity of Clipperton Island they were observed in mixed flocks of birds, consisting of such species as the Dark-rumped Petrel, Wedge-tailed Shearwater *(Puffinus chlororhynchus)*, Noddy, Clipperton Noddy, Blue-faced Booby, and Sooty Tern. On a squally day I noted an adult male dead on the water, evidently struck down by a wave.

At Clipperton Island Brewster's Boobies were nesting abundantly all around the island, here and there interspersed with colonies of Blue-faced Boobies, which, however, were not nesting. Of the Brewster's Boobies, some had eggs and others naked young. The nests were mere depressions lined with wing-quills.

The first birds of the Cocos Island colony were seen on September 1st, when some thirty or forty miles south of that island. On the 2nd they were fairly common; in the morning they were noted flying away from the island, and in the evening towards it. In this region their headquarters were on a small island offshore, situated between the small outlying islands of Nuez and Cascara. Only two or three individuals were observed on the main island. On September 13 we found them nesting abundantly, little hollows in the soil amongst the rocks and grass on the steep slopes of the island being utilized for nesting-sites. Naked and downy young and eggs, sometimes one, sometimes two, were found.

On the voyage home from the Galapagos Islands in 1906, from one to three birds were seen on October 4, 5, 7, 8, 10, and 13. On October 4 the "Academy" was in latitude 14° 24′ North, longitude 107° 5′ West; on October 13 in latitude 15° 36′ North, longitude 110° 12′ West. One bird taken had a number of ticks attached to its gular sac.

Adult Clipperton birds had the following colors of the naked parts in life: Males—Bill glaucous blue; gular sac indigo-blue; feet pea-green; iris silvery gray, distinct on the outer edge, but nearly obscured by black on the inner edge. Females—Bill olive-buff; gular sac indigo-blue, washed with pea-green; feet pea-green.

Although the Academy's series of Revilla Gigedo birds is very small, what few there are seem to be intermediate in color between the Cocos and the Clipperton birds, leaning distinctly toward the latter.

None of the Academy's series are moulting the primaries. Clipperton birds, however, have their primaries and tails extremely abraded in many cases; in fact, among the females it was impossible to obtain measurements of the length of tail, as it was broken off in every case. Clipperton birds probably renew their plumage by a postnuptial moult about September and October.

In the vicinity of San Benedicto and of Clipperton, we captured a number of birds which were passing from a brown immature plumage into the adult plumage. Two small white downy young from Cocos show the tip of the upper mandible to be more abruptly decurved in birds of that age than in adults.

The measurements in Table XII, p. 117, show that Clipperton birds average slightly larger than Cocos birds.

A series of twenty-four eggs from Cocos Island are all stained a dirty brown, evidently on account of the dampness of the nests, which is incidental to the rains which deluge the island daily. Sixteen of these eggs compose sets of two each, while the remaining eight compose sets of one each. The extreme and average measurements, in millimeters, for the whole series are as follows: Length 50.3–63.1 (58.7); breadth 37.5–42.5 (39.8).

The measurements of the eight sets of two eggs each show that there is some variation in size in the eggs of each set. By sets these eggs measure as follows: 53.6×40, 54.5×40; 63×41.6, 58.9×39.5; 58.3×40, 55.5×38.2; 62.5×39, 59.7×37.5; 62×39.9, 60×39.6; 60×40.2, 58.5×39.5; 63.1×42.5, 60.1×42; 62.2×40.7, 62.5×39. From the above it is plainly seen that there is considerable variation in the ratio of length

to breadth, or in other words, that the eggs vary considerably in shape. The extreme forms are ovate and elliptical-ovate.

### Fregata aquila: MAN-O'-WAR BIRD

Plates VI and VII

Abingdon, Albemarle, Barrington, Bindloe, Brattle, Champion, Charles, Chatham, Culpepper, Daphne, Duncan, Enderby, Gardner-near-Charles, Gardner-near-Hood, Hood, Indefatigable, James, Jervis, Kicker, Narborough, Onslow, Seymour, Tower, and Wenman islands.

The Man-o'-war Bird is present at all times about the coasts and waters of the Galapagos Islands, often being seen flying over the land as well as the sea, usually at a considerable height. At the fresh-water crater-lake, "El Junco," on Chatham Island, at an elevation of about twenty-six hundred feet, several were observed bathing, or perhaps drinking,[1] by swooping down and letting their feathers touch as they passed over the surface of the water. They frequently came about the vessel in company with the Graceful Petrel, particularly when turtle or tortoise fat was thrown overboard. One taken off southern Albemarle on April 27 had a very small turtle in its stomach.

I have never seen this species resting voluntarily on the water; in fact, the feathers become wet in a very short time if immersed. It was seldom observed on shore except at the nesting-places, where it was abundant. Outside of these resorts, an occasional bird was seen sitting on the top of some mangrove or on a jutting rock of a sea-cliff.

The Academy's Expedition found Man-o'-war Birds nesting on the following seven islands: Brattle in October; Culpepper in September; Enderby in May; Gardner-near-Hood in September; Hood in February, June, and September; Tower in September; Wenman in September.

In the latter part of September, 1905, there was quite a large colony nesting near the southeast extremity of Hood Island. The majority of the nests contained well-feathered young, although three fresh eggs were taken on September

[1]Cf. Fisher, Bull. U. S. Fish Comm., 1903, p. 31; Bonhote, Ibis, 1903, p. 312; Lowe, Ibis, 1909, p. 334.

27. The nests rested on the tops of small shrubs (*Sesuvium*) and were made of the dried stems of those plants. At the same time on the neighboring Gardner Island there was a small colony nesting in some bushes on the side of a cliff on the north side of the island. The nests were built of twigs and contained downy young.

On Brattle Island, October 30, they were likewise found nesting in low bushes. The nests were built of twigs and contained only well-feathered young.

In early February the Man-o'-war Birds were just beginning to nest again on southeast Hood. As in the preceding September, the nests were placed on the tops of small shrubs about six inches above the ground. Many nests were almost touching each other, so close together were they built. At this time nesting had evidently only begun, for we saw a male carrying nesting material, and all the eggs observed were fresh. Males as well as females were sitting on the nests, many of the former having their bright red pouches distended. The majority of the males were in the iridescent black plumage. When sitting on the nest, the male often gives a call, which resembles a chuckling laugh. I have never heard this call except in the mating season. Both males and females on the nest were silent when approached, but often defended their homes quite vigorously, using their bills with telling effect. During our February visit a pair were observed in the act of coition on the nest, the male balancing himself quite adroitly.

A very small young one in the down was taken on Enderby Island on May 14.

On our third visit to Hood Island in the latter part of June, a great many young which had just left the nest were observed, all having pale brownish heads and necks and white under parts. These were undoubtedly hatched from the eggs laid in February. A good-sized flock of young birds remained constantly over us, without beating their wings, as we sailed along the coast, keeping the decks of the schooner spattered with their droppings. On the southeast part of the island we found a good many nests which contained young still in the down. One youngster was being cared for by a Peruvian Booby. Of the Man-o'-war Birds, males as

well as females were guarding the young. When approached they usually remained quiet, only making a few passes at one with their beaks. The youngsters, however, were quite noisy and anxious to bite. An examination of the stomachs of several young disclosed the remains of flying-fish. One adult male was observed with a bright red distended pouch, which seemed to be unusual at that time, as all the others had dull-colored ones. This same male also uttered the chuckling call so commonly heard during the mating season. Other males gave an occasional harsh scream. The air above the nesting-site was constantly alive with birds flying hither and thither.

In the middle of September, 1906, Man-o'-war Birds were found nesting all along the north coast of Tower Island, and as far inland as the top of the island and the rim of the crater. The nests were small, built of sticks, and placed in low *Bursera* trees at an average of about seven feet from the ground. Young in the down in all stages were found. When approached, the youngsters would open their bills and squeak in a threatening manner.

On Wenman Island, on September 24, 1906, a few young in down were noted on the ground and on small shrubs growing on the ledges of a steep hillside on the northwest side of the island. On the plateau on the same side, several pairs were found nesting in bushes about three feet above the ground. One pair had a fresh egg, another a newly-hatched youngster.

On a visit to Culpepper Island on September 25, 1906, a number of young in the down were seen.

A very young bird in the down, taken on Enderby Island, had china-blue feet and bill, the latter tipped with white. The entire skin over the body was also china-blue.

The colors of the naked parts of birds taken on Hood in the latter part of June, when the adults were in worn plumage and the organs of reproduction small, were as follows: Orbital ring black in adult males, red in adult females, and pale blue in immature birds. Bills were pale blue in all but adult males.

Three birds with large sexual organs were taken at Academy Bay, Indefatigable Island, on July 16. Two were adult females with orbital rings dark blue, gular sacs purplish,

and feet red. The remaining bird, an adult male, had a bright red gular sac.

The farthest south we saw the Man-o'-war Bird was latitude 3° 41′ South on June 12, 1906. East of the archipelago we met with it occasionally on the ocean, but it was nowhere seen in any numbers except at Manta Bay, Ecuador.

On the voyage out from San Francisco we saw the first Man-o'-war Bird at the Tropic of Cancer on July 22. At San Benedicto, Revilla Gigedo Islands, they were nesting abundantly on July 26, the nests being situated on the low land as well as on a high mesa. The nests were built on the top of clumps of grass, and in most cases contained a single white fresh egg. Six nests out of about two hundred contained two eggs each.

On July 27 and 28 we saw a number of Man-o'-war Birds about the coast of the neighboring Socorro Island. On the voyage from Socorro to Clipperton Island, Mexico, they were seen occasionally. At Clipperton, August 10, we saw none on the island, but there were two or three hundred sailing over it during the forenoon. About noon they all headed out to sea in an easterly direction.

Between Clipperton and Cocos Island, Costa Rica, a few were seen. At Cocos, during the first half of September, they were very common over the water and in the high trees in the forest. Many males in fine glistening black plumage were observed flying about with their bright red pouches distended; so, evidently, September was the opening of the breeding-season, and undoubtedly the nests were placed in the tops of the tall trees, where so many of the birds could be seen and heard. At Cocos they persecuted the small Clipperton Noddies as well as the boobies.

On the voyage home from Culpepper Island, we saw several on September 26th in latitude 3° 29′ North, longitude 93° 6′ West; on the 27th in latitude 5° 34′ North, longitude 95° 27′ West. Then came a hiatus until October 7th, when one was seen in latitude 14° 38′ North, longitude 109° 12′ West. After that they were seen every day or so until October 24th, latitude 19° North, longitude 116° 41′ West. They frequently made unsuccessful attempts to alight on the topmast of the schooner.

With one exception all the specimens of *Fregata aquila* in the Academy's collection are from the Galapagos Islands. Birds in juvenal plumage, and assuming juvenal plumage, have the entire head and neck a rich cinnamon-rufous. No exception to this is found in the Academy's series.

Five adult males and six adult females from the Galapagos Islands measure in millimeters as follows: Males—Wing 595–660 (633); tail 400–490 (463); culmen 90–114 (104); tarsus 18.6–23 (21.2); middle toe 46–51.4 (49.1). Females—Wing 680–710 (696); tail 480–515 (503); culmen 122–127 (125); tarsus 21–23.7 (22.7); middle toe 51–57 (54.8).

A series of sixty-seven eggs from San Benedicto and a series of thirty-seven from the Galapagos Islands give practically the same average length and breadth. Among the sixty-seven San Benedicto eggs, however, the difference between the extremes is greater, as can be seen from the following measurements in millimeters: San Benedicto—Length 63.1–77 (69.6); breadth 43–50.6 (47.2). Galapagos—Length 64.1–74.6 (69.3); breadth 45.5–49.4 (47.5). A set of two eggs from San Benedicto measured 68.9×47.2, 71.1×46.2.

**Phaethon æthereus:** Red-billed Tropic-bird

Abingdon, Albemarle, Barrington, Brattle, Champion, Charles, Chatham, Culpepper, Daphne, Hood, Indefatigable, Onslow, Tower, and Wenman islands.

Red-billed Tropic-birds were not seen in any numbers except at Daphne, Hood, and Tower islands. They, were seen, however, through the entire year. Usually they travelled singly or in couples, but not in flocks. When met with away from land, they frequently flew about the vessel two or three times, keeping quite high in the air. The farthest point south of the Galapagos Islands at which we saw these birds was in 2° 36′ south latitude.

During the breeding-season at Daphne Island I saw birds circling about holes on the hillsides without beating their wings. Whenever they came opposite certain holes they would flutter their wings to check their flight, and come to a standstill for an instant, as though about to alight, but they would continue their circle. This was repeated ten or twelve

times before the bird finally entered the hole. On Hood Island they usually went directly to their holes without hesitation.

Only twice in the archipelago were these birds seen on the water; once I saw three off Daphne Island, and on another occasion one off Mt. Pitt, Chatham Island. In the latter case the bird flew as we passed and shook itself just after getting out of the water. As far as we observed, the tropic-birds are practically immune from the attacks of Man-o'-war Birds. On one occasion only did I see Man-o'-war Birds harass a tropic-bird, and then without success.

The food of the Red-billed Tropic-bird, as shown by the stomachs examined, consists of fish and squids. These were very often disgorged by both young and old when they were taken from their burrows. This species dives for its food somewhat like a tern.

Red-billed Tropic-birds could be recognized at almost any time by their cry, which is long and shrill and consists of a lot of short, high, rasping notes given in quick succession. Birds flying about the nesting-places often gave it, and birds disturbed on the nest also gave it. The young when taken from the nest uttered the same cry, and I have even heard a young bird only a day or so old give three or four notes of it when handled.

The nesting-places were usually holes in cliffs and hillsides in the vicinity of the sea. As a rule the single egg was laid at the end of a short burrow or in a cavity under a rock, but sometimes it was laid in an open depression. I have found them nesting two or three hundred feet above the sea, as for instance, on Daphne Island, where they nest from top to bottom of the island. Often two birds would be taken from a burrow; when such was the case no eggs or young were found. One bird which I disturbed on its nest was in a good light so that I could see it. It was sitting on its egg with wings drooping at its sides, feathers raised, and every feature showing rage at my intrusion.

The following are some of the breeding-places: Daphne in April and November; Hood in February, September, and October; Onslow in February. Young birds and eggs were taken on Daphne in the latter part of November; a fresh egg

was taken on Hood, September 28, 1905, and eggs and young in early February, 1906. On Hood I took a bird and a fresh egg from a nest, in which five days before a pair of Swallow-tailed Gulls held sway. Many tropic-birds were occupying nests the owners of which had been killed less than a week before. These facts give some idea of the great demand for nesting sites on southeast Hood. At Onslow Island on February 25, I noticed two birds in holes in a rock about twenty feet above the water, and I also saw a bird enter a hole.

On the voyage south from San Francisco we first met with the Red-billed Tropic-bird to the west of San Martin Island, Baja California, on July 9 and 10. We again saw one on July 22 in latitude 22° 25′ North, longitude 112° 40′ West. At San Benedicto, Revilla Gigedo Islands, they were fairly common, and we saw some in holes in cliffs over the ocean. On the coast of Ecuador, in the vicinity of Manta, on September 18, 19, and 20, we saw several. So all in all, it did not prove a common species at sea on the voyage from San Francisco to the Galapagos Islands.

On the homeward voyage from the Galapagos, we saw single birds on seven occasions, beginning on September 28, 1906, in latitude 7° 23′ North, longitude 97° 48′ West, and ending on November 4, in latitude 26° 50′ North, longitude 126° 47′ West.

In life, the adults have the bill of a crimson color; outer part of toes and webs black; tarsi and inner part of toes and webs ochraceous buff; under sides of toes and webs pearl-gray. The bills of the unfledged young are grayish and yellowish, while the bills of the fully fledged young are a distinct yellow.

An examination of the Academy's series of adults from the Galapagos Islands shows specimens from Daphne in November, which are apparently just completing a postnuptial moult, as testified by new and growing primaries. The same remarks apply to a specimen taken at Hood in February.

From the measurements given below, it appears that the sexes are evenly matched in size. The long tail-feathers, however, are so subject to wear and tear that it is doubtful if any one measurement represents the total length of the longest tail-feather in an absolutely perfect state. Of the

series of thirty-six males measured seventeen had tail-feathers from 600 to 790 millimeters in length (average 658), while of thirty-four females only two had tail-feathers over 600 millimeters in length (one measured 610, the other 667; average 639). The remaining measurements, in millimeters, are as follows: Thirty-six males—Wing 301–332 (314); culmen 60.1–69.7 (64.7); tarsus 24.8–28.2 (26.5); middle toe 33.5–38.1 (36.2). Thirty-four females—Wing 304–335 (314); culmen 59–70 (63.9); tarsus 25-28 (26); middle toe 34.2–39.5 (36.5).

The Academy's series of fifteen eggs shows apparently the full variation in markings and shape ascribed in the books to the eggs of this species. The fifteen eggs, representing as many sets, yield the following extreme and average dimensions: Length 54.5–67.2 (61); breadth 41.1–45.1 (43).

### **Phaethon rubricaudus**: Red-tailed Tropic-bird

The Red-tailed Tropic-bird was positively identified on three occasions. On July 30, 1905, we saw one in latitude 14° 58′ North, longitude 110° West. On August 21, 1905, in latitude 7° 3′ North, longitude 101° 36′ West, one was shot, but we failed to pick it up because of the speed at which the schooner was sailing. On October 22, 1906, in latitude 17° 53′ North, longitude 114° 45′ West, one circled about the vessel several times.

On two occasions we saw birds which were unquestionably of this species far north of the Tropic of Cancer. The first case occurred on November 7, 1906, in latitude 29° 38′ North, longitude 129° 2′ West, when three flew about the vessel. The second case was on November 13, in latitude 32° 38′ North, longitude 133° 32′ West, when one flew about the vessel.

### **Pelecanus fuscus**: Brown Pelican

Abingdon, Albemarle, Barrington, Bindloe, Brattle, Charles, Chatham, Cowley, Daphne, Duncan, Gardner-near-Hood, Hood, Indefatigable, James, Jervis, Narborough, Seymour, and Tower islands.

When travelling along the rocky shores of the larger islands, we frequently met with the Brown Pelican, usually

singly. When not fishing, this bird roosts on the rocks and on the mangroves which are in many places found growing along the sea-coast proper. Once or twice it was seen on the ledges of sea-cliffs. Although quite easy to approach, it was somewhat warier than the boobies. Occasionally one could be surprised while standing asleep with its bill stuck down the middle of its back. When approached closely, this species keeps its wings trembling as if nervous. The habit is perhaps similar to the twitching of the tail in certain herons.

In the Galapagos Islands Brown Pelicans serve as scavengers. On several occasions they were observed to pick up the bodies of large birds, after we had skinned them and thrown them overboard. In one case an immature pelican had got the bodies of two Galapagos Hawks into its pouch, and was unable to swallow them. Likewise it was unable to fly on account of the weight. It was probably grateful when we rowed up to it, where it was sitting on the water, and removed the impedimenta, for it flew away joyfully enough afterwards.

We never saw a pelican make a graceful dive. Invariably they just tumbled into the water from a few feet above it. They often fished along the line of small breakers close to the shore, and after making such a dive, frequently had to get up hurriedly to avoid being overwhelmed by a wave.

No noise was ever heard from this species, except from the young birds in the nests; and they can squawk vociferously—the squawk being long and hoarse.

When nesting, the adult will frequently allow a person to approach within two or three feet of it before leaving the nest, which it makes no attempt to defend. I saw a pair copulating on their nest at Tagus Cove, Albemarle Island, on April 1. They had no eggs in the nest. All of the other nests of the colony of ten or twelve had single birds on them. Some had eggs, others none. The nests were bulky affairs of sticks built in bushes on a steep hillside close to the water. The area occupied was about one hundred yards by twenty-five yards. The birds were somewhat wary, some flying upon the near approach of the boat.

At South Seymour Island, on November 22, three nests were seen in a low tree near the shore. Two had one young-

ster each, and the third two. On northern Indefatigable, November 25, nests with young were observed in the mangroves and also on the ground. On Jervis Island, December 18, a young bird in the down was found in a nest in a low bush at the top of a beach. At Academy Bay, Indefatigable Island, in early November, young were observed in nests built at least twenty feet above the ground in the mangroves. In the middle of the following January the same birds were observed fishing, apparently under the supervision of their parents, whose example they followed in diving into the water.

On March 12, a few miles west of Villamil, Albemarle Island, four occupied nests were found in the low mangroves fringing the rocky shore. They were built in the usual bulky style, and the two which were examined each contained three incubated eggs. At Banks Bay, Albemarle, April 11, three nests were found in some small mangroves about eight feet high. They were shallow, built of sticks, lined with grass, and placed very little above the high-water mark. One had naked youngsters in it; the second contained three eggs; and the third was new.

In the middle of July, at Academy Bay, the same nests which had young in them the previous November, again contained partly-fledged, squawking youngsters, eight months only having elapsed since the previous brood. They were fed by running their bills well into the parent's pouch and gulping in the food.

Brown Pelicans bathe after the manner of most water-birds, by beating the water with their wings. They were occasionally "decoyed" to wounded birds. One day two or three of this species and several Man-o'-war Birds flocked about when a Blue-footed Booby was shot. As a rule the pelicans did not associate with other species. Once or twice, however, they were observed fishing along with Blue-footed Boobies, and at times roosting with them.

It was not unusual to see several Noddies fluttering excitedly about a pelican when it was fishing, and often sitting on its head[1] while it swallowed the fish. Once I saw two on a pelican's head at one time. The pelicans never seemed to be annoyed, nor did the Noddies ever get any fish so far as I

[1]Cf. Audubon, Orn. Biog., v. 3, pp. 379, 380; v. 5, p. 213; Wells, Auk, v. 19, p. 242.

could see. Dusky Shearwaters would occasionally fly about a pelican, apparently to pester it, for one day I observed a pelican take refuge on the top of a cliff from a number of them.

A comparison of the average measurements of a small series of Galapagos and California birds shows the California birds to be slightly the larger. The maximum, minimum, and average measurements in millimeters of the Academy's series of adults from these two localities are given in Table XIII, p. 118.

# TABLES OF MEASUREMENTS (in millimeters)

## TABLE I—Nesopelia galapagoensis

| Islands | Sex | Number of Specimens | Wing | | | Tail | | | Culmen | | | Tarsus | | | Middle Toe | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Minimum | Maximum | Average | Minimum | Maximum | Average | Minimum | Maximum | Average | Minimum | Maximum | Average | Minimum | Maximum | Average |
| Abingdon | ♂ | 2 | 123 | 128 | 125 | 67 | 70 | 68 | 16.7 | 18 | 17.4 | 23 | 24 | 23.5 | 23 | 24 | 23.5 |
| Barrington | ♂♂ | 12 | 127 | 138 | 134 | 67 | 80 | 73 | 17 | 19 | 18.1 | 22.3 | 25 | 23.7 | 22 | 24.5 | 23.3 |
| Charles | ♂♂ | 2 | 130 | 132 | 131 | 74 | 74 | 74 | 17.1 | 17.3 | 17.2 | 25 | 25 | 25 | 23.4 | 24 | 23.7 |
| Chatham | ♂ | 1 | 130 | 130 | 130 | 63 | 63 | 63 | 17.8 | 17.8 | 17.8 | 24.7 | 24.7 | 24.7 | 23.6 | 23.6 | 23.6 |
| Culpepper | ♂♂ | 3 | 133 | 143 | 139 | 73 | 80 | 77 | 18 | 18.5 | 18.3 | 24.5 | 27 | 26.2 | 24.5 | 25 | 24.8 |
| Duncan | ♂♂ | 33 | 124 | 139 | 132 | 66 | 80 | 73 | 16.8 | 19.5 | 17.8 | 23 | 25.5 | 24.1 | 21.8 | 25 | 23.2 |
| Gardner-near-Charles | ♂♂ | 2 | 121 | 134 | 127 | 68 | 78 | 73 | 16.7 | 18.3 | 17.5 | 22 | 23.4 | 22.7 | 20.4 | 23.3 | 21.8 |
| Gardner-near-Hood | ♂♂ | 6 | 130 | 138 | 133 | 72 | 79 | 75 | 16.2 | 18.4 | 17.1 | 23.5 | 25 | 24.3 | 23 | 24.8 | 23.6 |
| Hood | ♂♂ | 11 | 130 | 139 | 133 | 73 | 80 | 75 | 16.7 | 18.7 | 17.9 | 23.3 | 25.5 | 24.6 | 20.7 | 24.2 | 23.2 |
| Indefatigable | ♂♂ | 8 | 118 | 138 | 130 | 64 | 79 | 71 | 16.4 | 18.4 | 17.6 | 22.3 | 25.5 | 24.3 | 20 | 24.2 | 22.6 |
| Jervis | ♂♂ | 4 | 129 | 138 | 133 | 75 | 81 | 77 | 18.7 | 19.3 | 19 | 24.3 | 25 | 24.7 | 22 | 23 | 22.5 |
| Narborough | ♂ | 1 | 133 | 133 | 133 | 74 | 74 | 74 | 16 | 16 | 16 | 24.2 | 24.2 | 24.2 | 22 | 22 | 22 |
| Wenman | ♂♂ | 8 | 131 | 142 | 136 | 68 | 82 | 77 | 17.5 | 19.2 | 18.1 | 25.4 | 27.3 | 26.1 | 23.4 | 24.8 | 23.9 |
| Abingdon | ♀ | 5 | 114 | 121 | 118 | 57 | 67 | 60 | 14.6 | 16.2 | 15.5 | 19.8 | 21.5 | 20.9 | 19.8 | 22 | 21.1 |
| Barrington | ♀ | 4 | 118 | 123 | 119 | 61 | 70 | 66 | 16 | 17 | 16.5 | 21 | 22.6 | 21.7 | 20.5 | 21.3 | 20.9 |
| Bindloe | ♀ | 1 | 124 | 124 | 124 | 65 | 65 | 65 | 16.5 | 16.5 | 16.5 | 22.7 | 22.7 | 22.7 | 21 | 21 | 21 |
| Chatham | ♀ | 2 | 117 | 123 | 120 | 62 | 71 | 66 | 16.3 | 16.6 | 16.5 | 21.5 | 22.3 | 21.9 | 20.2 | 21.5 | 20.9 |
| Culpepper | ♀ | 1 | 131 | 131 | 131 | 68 | 68 | 68 | 17.2 | 17.2 | 17.2 | 22.2 | 22.2 | 22.2 | 21.2 | 21.2 | 21.2 |
| Duncan | ♀ | 8 | 117 | 123 | 119 | 61 | 67 | 63 | 15.3 | 17 | 16 | 20 | 22.1 | 21.7 | 20 | 22 | 21.1 |
| Gardner-near-Charles | ♀ | 1 | 119 | 119 | 119 | 60 | 60 | 60 | 16.1 | 16.1 | 16.1 | 22 | 22 | 22 | 21.1 | 21.1 | 21.1 |
| Gardner-near-Hood | ♀ | 1 | 123 | 123 | 123 | 66 | 66 | 66 | 16 | 16 | 16 | 20.3 | 20.3 | 20.3 | 20.2 | 20.2 | 20.2 |
| Hood | ♀ | 16 | 118 | 125 | 121 | 58 | 69 | 64 | 15.6 | 17.8 | 16.6 | 21 | 23 | 22.3 | 19.7 | 21.6 | 20.6 |
| Indefatigable | ♀ | 15 | 115 | 125 | 119 | 60 | 71 | 65 | 15.5 | 17.5 | 16.4 | 21.6 | 23 | 22.3 | 18.3 | 20.6 | 19.7 |
| James | ♀ | 4 | 118 | 129 | 124 | 63 | 71 | 67 | 15.6 | 17.1 | 16.3 | 22.2 | 23 | 22.6 | 20.7 | 21.5 | 21 |
| Jervis | ♀ | 11 | 118 | 126 | 121 | 62 | 69 | 66 | 15.8 | 18.2 | 16.7 | 21.2 | 23.2 | 22.6 | 19 | 21.8 | 19.9 |
| South Seymour | ♀ | 8 | 120 | 126 | 122 | 65 | 73 | 68 | 15.1 | 17.3 | 16.4 | 21.6 | 23.5 | 22.6 | 19.1 | 20.6 | 20 |
| Tower | ♀ | 1 | 115 | 115 | 115 | 55 | 55 | 55 | 16 | 16 | 16 | 21 | 21 | 21 | 19.2 | 19.2 | 19.2 |
| Wenman | ♀ | 3 | 121 | 128 | 125 | 68 | 71 | 69 | 16 | 17 | 16.6 | 23 | 24.7 | 24 | 19.7 | 21.3 | 20.3 |

TABLE II—**Creciscus spilonotus**

| Island | Sex | Number of Specimens | Wing | | | Tail | | | Culmen | | | Tarsus | | | Middle Toe | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Minimum | Maximum | Average | Minimum | Maximum | Average | Minimum | Maximum | Average | Minimum | Maximum | Average | Minimum | Maximum | Average |
| Abingdon | ♂ | 1 | 70 | 70 | 70 | 25.5 | 25.5 | 25.5 | 16 | 16 | 16 | 21.1 | 21.1 | 21.1 | 24 | 24 | 24 |
| Indefatigable | ♂ | 33 | 61 | 72 | 66 | 20 | 25 | 23 | 15 | 17.7 | 16.3 | 19.5 | 22.9 | 21.5 | 22 | 25.4 | 24.2 |
| James | ♂ | 4 | 69 | 70 | 69.5 | 24 | 26 | 25 | 16.2 | 17.3 | 16.9 | 21.2 | 23.4 | 22.6 | 25.1 | 26 | 25.6 |
| South Seymour | ♂ | 1 | 68 | 68 | 68 | 25 | 25 | 25 | 15.4 | 15.4 | 15.4 | 21 | 21 | 21 | 23 | 23 | 23 |
| Abingdon | ♀ | 2 | 64 | 68 | 66 | 22 | 25 | 23 | 15 | 15.1 | 15 | 20.5 | 21.7 | 21.1 | 23.7 | 23.8 | 23.7 |
| Indefatigable | ♀ | 28 | 61 | 72 | 66 | 21 | 26 | 23 | 14.7 | 16.6 | 15.5 | 19.7 | 22.1 | 21 | 21.8 | 25.4 | 23.6 |
| James | ♀ | 8 | 66 | 72 | 68 | 24 | 27 | 25 | 15.3 | 16.5 | 15.9 | 21.3 | 22.6 | 21.8 | 24 | 25.2 | 24.7 |

TABLE III—**Spheniscus mendiculus**

| No. | Age | Sex | Date | Plumage | Flipper[1] | Tail | Culmen | Tarsus[2] | Middle Toe and Claw |
|---|---|---|---|---|---|---|---|---|---|
| 338 | Adult | ♂ | Mar. 21 | Somewhat worn | 149 | 27 | 57.4 | 26 | 56.8 |
| 340 | Adult | ♂ | Dec. 8 | Fresh | 166 | 39 | 61.1 | 29 | 62 |
| 349 | Adult | ♂ | Dec. 6 | Worn | 157 | 24 | 60.5 | 31.6 | 59.5 |
| 339 | Adult | ♂ | Aug. 8 | Worn | 155 | 23 | 61 | 30.5 | 62.5 |
| 341 | Adult | ♂ | July 26 | Worn | 152 | 24 | 61 | 27.7 | 60 |
| 353 | Immature | ♂ | Mar. 21 | Somewhat worn | 143 | 24 | 56.6 | 25.5 | 58.5 |
| 342 | Immature | ♂ | Dec. 8 | Fresh | 150 | 32 | 58 | 28 | 61.9 |
| 348 | Adult | ♀ | Mar. 29 | Somewhat worn | 147 | 27 | 56 | 26.1 | 60 |
| 343 | Adult | ♀ | Apr. 6 | Somewhat worn | 140 | 25 | 56.2 | 26.2 | 56.3 |
| 350 | Adult | ♀ | Mar. 21 | Slightly worn | 148 | 27 | 57.4 | 26 | 60.5 |
| 351 | Adult | ♀ | Mar. 21 | Somewhat worn | 154 | 30 | 57.1 | 29 | 59 |
| 352 | Adult | ♀ | Mar. 21 | Somewhat worn | 144 | 28 | 57 | 28.6 | 58.5 |
| 344 | Adult | ♀ | Mar. 24 | Fresh | 150 | 26 | 56 | 27.3 | 59 |
| 345 | Adult | ♀ | Dec. 8 | Fresh | 154 | 27 | 57 | 25.7 | 60.7 |
| 347 | Adult | ♀ | Dec. 8 | Worn | 155 | 19 | 56.8 | 28.5 | 58.5 |
| 346 | Immature | ♀ | Dec. 28 | Fresh | 153 | 33 | 54.7 | 25 | 61.5 |
| 354 | Immature | | Apr. 11 | Worn | 151 | 23 | 58 | 26 | 61 |

[1] Flipper, from insertion.
[2] Tarsus, from lower edge of tibial feathers, in front.

TABLE IV—Anous stolidus

| Locality | Sex | Number of Specimens | Wing | | | Tail | | | Culmen | | | Tarsus | | | Middle Toe | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Minimum | Maximum | Average | Minimum | Maximum | Average | Minimum | Maximum | Average | Minimum | Maximum | Average | Minimum | Maximum | Average |
| Revilla Gigedo | ♂ | 2 | 280 | 282 | 281 | 158 | 170 | 164 | 41.3 | 43 | 42.2 | 24.3 | 25.5 | 24.9 | 30.5 | 32.4 | 31.4 |
| Clipperton | ♂ | 3 | 263 | 285 | 277 | 160 | 165 | 162 | 39.4 | 41 | 40.2 | 24 | 25.5 | 24.5 | 30 | 33 | 31.6 |
| Cocos | ♂ | 8 | 282 | 291 | 285 | 161 | 173 | 165 | 38.8 | 42 | 40 | 22.4 | 25 | 24.1 | 29.3 | 32.2 | 31 |
| Galapagos | ♂ | 33 | 250 | 281 | 272 | 136 | 163 | 152 | 37.5 | 43.6 | 40.8 | 21.6 | 24.3 | 23.1 | 27.6 | 31.8 | 29.8 |
| Revilla Gigedo | ♀ | 2 | 275 | 275 | 275 | 157 | 160 | 158 | 38.4 | 41.1 | 39.7 | 24 | 24.1 | 24.1 | 29.7 | 30.5 | 30.1 |
| Clipperton | ♀ | 9 | 265 | 278 | 273 | 150 | 163 | 156 | 38 | 41 | 39.4 | 23.5 | 25 | 24.1 | 29.5 | 31.7 | 30.6 |
| Cocos | ♀ | 3 | 270 | 279 | 274 | 151 | 167 | 157 | 37.5 | 39.9 | 38.8 | 22 | 23.6 | 22.9 | 28.5 | 30.5 | 29.7 |
| Galapagos | ♀ | 39 | 249 | 280 | 267 | 131 | 162 | 149 | 35.5 | 42.8 | 39.2 | 21 | 24 | 22.3 | 27.3 | 30.7 | 28.9 |

TABLE V—Micranous diamesus

| Island | Sex | Number of Specimens | Wing | | | Tail | | | Culmen | | | Depth of Bill at Base | | | Tarsus | | | Middle Toe | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Minimum | Maximum | Average | Minimum | Maximum | Average | Minimum | Maximum | Average | Minimum | Maximum | Average | Minimum | Maximum | Average | Minimum | Maximum | Average |
| Clipperton | ♂ | 16 | 216 | 241 | 230 | 112 | 132 | 123 | 40 | 48.4 | 44.1 | 8.2 | 10.6 | 9.4 | 19.2 | 21.6 | 20.3 | 26.5 | 28.5 | 27.5 |
| Cocos | ♂ | 10 | 228 | 240 | 233 | 119 | 130 | 124 | 43.5 | 47.2 | 45.3 | 8 | 9.9 | 8.6 | 19.5 | 21.4 | 20 | 26.5 | 28.9 | 28 |
| Clipperton | ♀ | 12 | 215 | 233 | 227 | 112 | 127 | 121 | 39.6 | 43 | 41.9 | 7.3 | 10.2 | 8.7 | 18.1 | 20.5 | 19.7 | 25 | 29 | 27.3 |
| Cocos | ♀ | 18 | 212 | 246 | 231 | 111 | 129 | 120 | 37.1 | 45.1 | 42.4 | 7 | 8.5 | 8 | 18.6 | 20.5 | 19.6 | 25.9 | 29.5 | 27.6 |

TABLE VI—Hæmatopus galapagensis

| Locality | Sex | Number of Specimens | Wing | | | Tail | | | Culmen | | | Tarsus | | | Middle Toe | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Minimum | Maximum | Average | Minimum | Maximum | Average | Minimum | Maximum | Average | Minimum | Maximum | Average | Minimum | Maximum | Average |
| Galapagos | ♂ | 19 | 248 | 265 | 257 | 93 | 107 | 100 | 73.8 | 91.5 | 81.4 | 47.2 | 52.5 | 49.3 | 38.2 | 43.5 | 40.3 |
| Baja California[1] | ♂ | 9 | 248 | 266 | 258 | 97 | 105 | 102 | 70 | 81.3 | 76.4 | 45.9 | 52 | 48.9 | 35 | 39.6 | 37.3 |
| Galapagos | ♀ | 17 | 252 | 268 | 259 | 92 | 103 | 98 | 79.6 | 93 | 87.4 | 46.3 | 51.9 | 49.4 | 38.7 | 43.1 | 41 |
| Baja California[2] | ♀ | 13 | 252 | 272 | 264 | 98 | 107 | 103 | 76 | 91 | 80.3 | 47.4 | 52.5 | 50.4 | 36.4 | 39.7 | 37.9 |

[1] The measurements of a male from the Coronados Islands, No. 5242 of Mr. Joseph Grinnell's collection, are included.
[2] The measurements of two females, Nos. 4488 and 4489 Museum of Vertebrate Zoology, University of California, are included. One is from Santa Barbara Island, California, and the other is from San Diego, California.

TABLE VII—Ardea herodias

| Locality | Sex | Number of Specimens | Wing | | | Tail | | | Culmen | | | Tarsus | | | Middle Toe | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Minimum | Maximum | Average | Minimum | Maximum | Average | Minimum | Maximum | Average | Minimum | Maximum | Average | Minimum | Maximum | Average |
| Galapagos | ♂ | 5 | 475 | 482 | 478 | 173 | 186 | 179 | 153 | 158 | 155 | 158 | 165 | 162 | 100 | 109 | 105 |
| California | ♂ | 11 | 480 | 512 | 492 | 174 | 193 | 184 | 135 | 154 | 148 | 162 | 192 | 176 | 101 | 113 | 106 |
| Galapagos | ♀ | 1 | 454 | 454 | 454 | 172 | 172 | 172 | 141 | 141 | 141 | 142 | 142 | 142 | 99 | 99 | 99 |
| California | ♀ | 19 | 455 | 493 | 477 | 172 | 193 | 179 | 125 | 144 | 136 | 150 | 180 | 165 | 90 | 104 | 98 |

TABLE VIII—Herodias egretta

| Locality | Sex | Number of Specimens | Wing | | | Tail | | | Culmen | | | Tarsus | | | Middle Toe | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Minimum | Maximum | Average | Minimum | Maximum | Average | Minimum | Maximum | Average | Minimum | Maximum | Average | Minimum | Maximum | Average |
| Galapagos | ♂ | 3 | 401 | 405 | 403 | 151 | 157 | 154 | 111 | 117 | 114 | 153 | 164 | 158 | 97 | 107 | 101 |
| Merced Co., California | ♂♂ | 9 | 393 | 416 | 409 | 143 | 177 | 159 | 116 | 125 | 120 | 157 | 176 | 166 | 97 | 110 | 104 |
| Galapagos | ♀♀ | 2 | 357 | 373 | 365 | 140 | 147 | 143 | 106 | 108 | 107 | 142 | 148 | 145 | 97 | 99 | 98 |
| Merced Co., California | ♀ | 11 | 363 | 401 | 383 | 140 | 153 | 146 | 99 | 123 | 111 | 137 | 155 | 146 | 92 | 99 | 95 |

TABLE IX—Nyctanassa violacea

| Locality | Sex | Number of Specimens | Wing | | | Tail | | | Culmen | | | Tarsus | | | Middle Toe | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Minimum | Maximum | Average | Minimum | Maximum | Average | Minimum | Maximum | Average | Minimum | Maximum | Average | Minimum | Maximum | Average |
| Cocos | ♂♂ | 2 | 293 | 300 | 296 | 106 | 111 | 108 | 77.8 | 81 | 79.4 | 92.8 | 94.9 | 93.8 | 64.4 | 64.8 | 64.6 |
| Socorro | ♂♂ | 1 | 279 | 279 | 279 | 110 | 110 | 110 | 62.9 | 62.9 | 62.9 | 79.8 | 79.8 | 79.8 | 60.4 | 60.4 | 60.4 |
| Galapagos | ♂♂ | 15 | 264 | 290 | 278 | 98 | 112 | 106 | 67.8 | 73.8 | 70.7 | 83 | 92 | 88 | 57 | 63 | 59.8 |
| Galapagos | ♀♀ | 2 | 270 | 282 | 276 | 104 | 108 | 106 | 69 | 70.4 | 69.7 | 85 | 86 | 85.5 | 55 | 56 | 55.5 |
| Georgia | ♀ | 1 | 288 | 288 | 288 | 100 | 100 | 100 | 71.2 | 71.2 | 71.2 | 95.9 | 95.9 | 95.9 | 60.2 | 60.2 | 60.2 |

## TABLE X—Butorides sundevalli

| ISLAND | SEX | NUMBER OF SPECIMENS | WING | | | TAIL | | | CULMEN | | | TARSUS | | | MIDDLE TOE | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Minimum | Maximum | Average | Minimum | Maximum | Average | Minimum | Maximum | Average | Minimum | Maximum | Average | Minimum | Maximum | Average |
| Abingdon | ♂ | 2 | 181 | 194 | 187 | 64 | 66 | 65 | 65 | 70 | 67.5 | 47 | 50.9 | 48.9 | 44.7 | 47 | 45.8 |
| Albemarle | ♂ | 4 | 186 | 190 | 188 | 62 | 67 | 63 | 65.5 | 69.5 | 67.3 | 48.5 | 51.1 | 49.8 | 43 | 48 | 45.1 |
| Barrington | ♂ | 1 | 188 | 188 | 188 | 61 | 61 | 61 | 70 | 70 | 70 | 48.7 | 48.7 | 48.7 | 47.6 | 47.6 | 47.6 |
| Chatham | ♂ | 4 | 178 | 193 | 185 | 60 | 68 | 64 | 67.2 | 68.9 | 68.2 | 48 | 50.2 | 49.3 | 42.9 | 47 | 45.3 |
| Daphne | ♂ | 1 | 178 | 178 | 178 | 60 | 60 | 60 | 63 | 63 | 63 | 48.6 | 48.6 | 48.6 | 45 | 45 | 45 |
| Duncan | ♂ | 2 | 179 | 182 | 180 | 62 | 62 | 62 | 67.8 | 68 | 67.9 | 46.8 | 47.6 | 47.2 | 44.2 | 44.9 | 44.5 |
| Gardner-near-Hood | ♂ | 4 | 183 | 190 | 186 | 60 | 66 | 64 | 67.8 | 71 | 69.3 | 49 | 49.4 | 49.2 | 44.3 | 46.4 | 45 |
| Hood | ♂ | 3 | 185 | 195 | 188 | 60 | 64 | 62 | 67.2 | 70 | 68.5 | 47 | 51.4 | 48.9 | 44.2 | 45.7 | 45 |
| Indefatigable | ♂ | 20 | 176 | 198 | 187 | 57 | 71 | 63 | 62 | 70.5 | 66.3 | 44.3 | 52.3 | 48.2 | 43 | 49 | 45.5 |
| Islet off N. E. James | ♂ | 1 | 189 | 189 | 189 | 64 | 64 | 64 | 65.5 | 65.5 | 65.5 | 50 | 50 | 50 | 48.9 | 48.9 | 48.9 |
| James | ♂ | 2 | 187 | 188 | 187 | 63 | 65 | 64 | 65.2 | 67.2 | 66.2 | 47.5 | 47.6 | 47.5 | 45.9 | 46.1 | 46 |
| Seymour | ♂ | 1 | 185 | 185 | 185 | 62 | 62 | 62 | 68 | 68 | 68 | 46.9 | 46.9 | 46.9 | 43.7 | 43.7 | 43.7 |
| Abingdon | ♀ | 3 | 179 | 186 | 183 | 59 | 67 | 63 | 63.9 | 67.3 | 65.7 | 46 | 49.9 | 47.8 | 43 | 45.4 | 44.5 |
| Albemarle | ♀ | 3 | 169 | 183 | 175 | 58 | 62 | 60 | 58.1 | 67.4 | 62.7 | 43.5 | 48.1 | 45.9 | 39.3 | 44 | 42.2 |
| Bindloe | ♀ | 2 | 183 | 184 | 183 | 59 | 64 | 61 | 65 | 67.2 | 66.1 | 45.2 | 48.9 | 47 | 46 | 46.3 | 46.1 |
| Chatham | ♀ | 1 | 187 | 187 | 187 | 67 | 67 | 67 | 65.6 | 65.6 | 65.6 | 46 | 46 | 46 | 43.9 | 43.9 | 43.9 |
| Daphne | ♀ | 3 | 178 | 187 | 181 | 56 | 64 | 60 | 62 | 66.7 | 64.5 | 46.6 | 49.4 | 47.7 | 44.2 | 45.8 | 44.8 |
| Duncan | ♀ | 1 | 188 | 188 | 188 | 70 | 70 | 70 | 67 | 67 | 67 | 46 | 46 | 46 | 41.9 | 41.9 | 41.9 |
| Gardner-near-Hood | ♀ | 2 | 184 | 189 | 186 | 65 | 66 | 65 | 66.4 | 69.2 | 67.8 | 47.7 | 51.2 | 49.4 | 44 | 45.7 | 44.8 |
| Hood | ♀ | 1 | 182 | 182 | 182 | 64 | 64 | 64 | 67.5 | 67.5 | 67.5 | 49.3 | 49.3 | 49.3 | 45 | 45 | 45 |
| Indefatigable | ♀ | 19 | 177 | 192 | 184 | 59 | 67 | 63 | 60.1 | 68 | 64.3 | 43.4 | 49.7 | 46.8 | 40.7 | 46.5 | 43.7 |
| Seymour | ♀ | 1 | 182 | 182 | 182 | 65 | 65 | 65 | 63 | 63 | 63 | 47.8 | 47.8 | 47.8 | 43.6 | 43.6 | 43.6 |

TABLE XI—Sula variegata *and* Sula cyanops

| Species | Sex | Number of Specimens | Wing | | | Tail | | | Culmen | | | Tarsus | | | Middle Toe | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Minimum | Maximum | Average | Minimum | Maximum | Average | Minimum | Maximum | Average | Minimum | Maximum | Average | Minimum | Maximum | Average |
| Sula variegata | ♂ | 23 | 426 | 464 | 445 | 173 | 192 | 183 | 98.1 | 107 | 103.4 | 46.5 | 54.3 | 50.8 | 70 | 82 | 77.1 |
| Sula variegata | ♀ | 25 | 433 | 492 | 465 | 175 | 196 | 183 | 98.4 | 112 | 105.7 | 50 | 55.8 | 53.2 | 76.4 | 84.6 | 80.3 |
| Sula cyanops | ♂ | 7 | 414 | 426 | 420 | 170 | 178 | 175 | 99 | 106 | 102.6 | 51 | 55 | 53.4 | 73 | 78 | 75.7 |
| Sula cyanops | ♀ | 6 | 428 | 440 | 432 | 173 | 187 | 180 | 100 | 106 | 103 | 53 | 57 | 55 | 75 | 80 | 78 |

TABLE XII—Sula brewsteri

| Locality | Sex | Number of Specimens | Wing | | | Tail | | | Culmen | | | Tarsus | | | Middle Toe | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Minimum | Maximum | Average | Minimum | Maximum | Average | Minimum | Maximum | Average | Minimum | Maximum | Average | Minimum | Maximum | Average |
| San Benedicto | ♂ | 1 | 387 | 387 | 387 | 189 | 189 | 189 | 92.3 | 92.3 | 92.3 | 43.9 | 43.9 | 43.9 | 65 | 65 | 65 |
| Clipperton | ♂ | 8 | 374 | 401 | 391 | 189 | 199 | 194 | 90 | 97.5 | 94.3 | 41.5 | 44.7 | 43.2 | 61.9 | 66 | 63.9 |
| Cocos | ♂ | 23 | 371 | 408 | 388 | 176 | 196 | 186 | 85 | 97.2 | 91.4 | 39.3 | 44.5 | 41.1 | 56.5 | 64 | 60.2 |
| San Benedicto | ♀ | 1 | 416 | 416 | 416 | 194 | 194 | 194 | 98.8 | 98.8 | 98.8 | 45.9 | 45.9 | 45.9 | 63.8 | 63.8 | 63.8 |
| Clipperton | ♀ | 8 | 401 | 419 | 412 | | | | 91 | 102 | 98.1 | 43.2 | 47 | 45.6 | 61.2 | 67.7 | 65.6 |
| Cocos | ♀ | 14 | 400 | 418 | 409 | 181 | 203 | 190 | 94 | 101 | 96.4 | 43 | 49 | 44.9 | 62 | 67 | 63.9 |

TABLE XIII—Pelecanus fuscus

| LOCALITY | SEX | NUMBER OF SPECIMENS | WING | | | TAIL | | | CULMEN | | | TARSUS | | | MIDDLE TOE | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Minimum | Maximum | Average | Minimum | Maximum | Average | Minimum | Maximum | Average | Minimum | Maximum | Average | Minimum | Maximum | Average |
| Galapagos | ♂ | 5 | 567 | 605 | 582 | 137 | 152 | 144 | 339 | 370 | 353 | 74.2 | 78 | 75.9 | 103 | 110 | 105 |
| California | ♂ | 13 | 570 | 607 | 588 | 141 | 163 | 150 | 342 | 384 | 361 | 77 | 84.8 | 81 | 103 | 112 | 107 |
| Galapagos | ♀ | 2 | 530 | 535 | 533 | 131 | 136 | 134 | 300 | 312 | 306 | 69.2 | 73 | 71.1 | 94 | 96.3 | 95.2 |
| California | ♀ | 9 | 540 | 555 | 546 | 134 | 154 | 145 | 292 | 334 | 322 | 68 | 80 | 74.8 | 93 | 101 | 97.3 |

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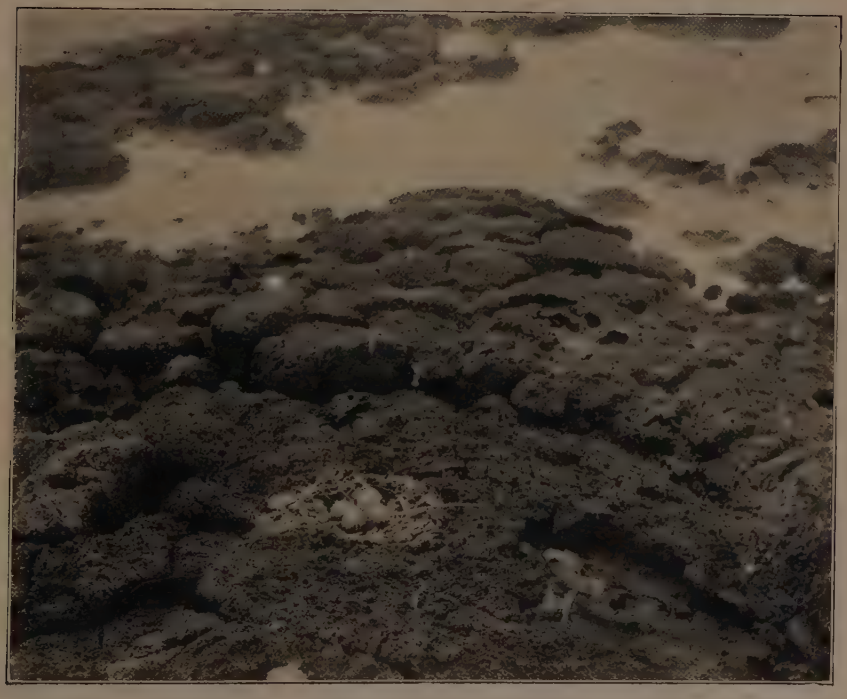
EXPLANATION OF PLATE I

Fig. 1. *Spheniscus mendiculus* (pp. 16-19).

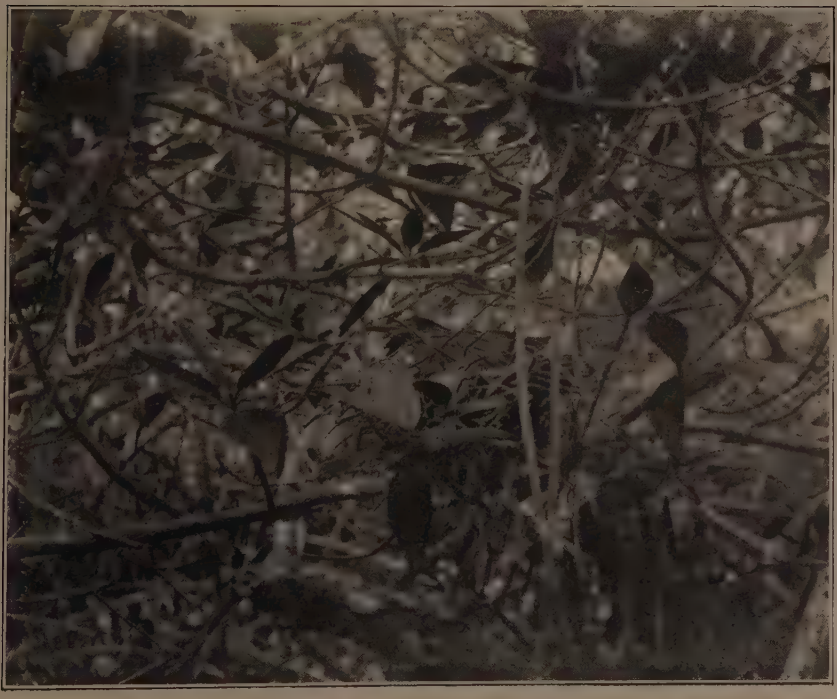
Fig. 2. Nest and eggs of *Himantopus mexicanus* (p. 54). Charles Island; February 25, 1906.



## EXPLANATION OF PLATE II

Fig. 1. Nest and eggs of *Nyctanassa violacea* (pp. 59–62). Albemarle Island; March 10, 1906.

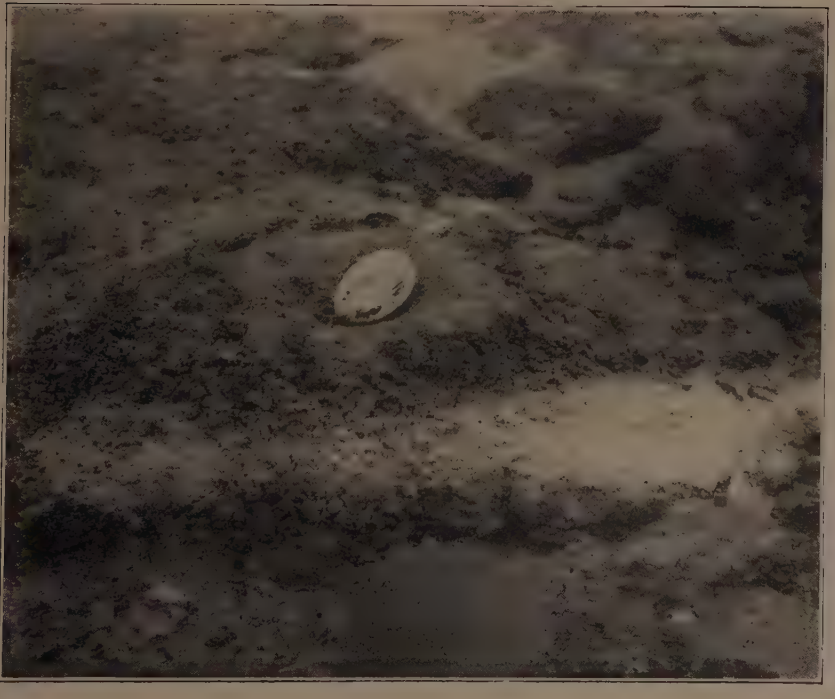
Fig. 2. *Butorides sundevalli* on nest (pp. 62–65). Chatham Island; February 10, 1906.



## EXPLANATION OF PLATE III

Fig. 1. Salt lagoon with nests of *Phœnicopterus ruber* at the edge of the brush. Note crystalline deposits at the water's edge (pp. 66–76). James Island.

Fig. 2. Nest and egg of *Phœnicopterus ruber* (pp. 66–76). Charles Island; February 25, 1906.



## EXPLANATION OF PLATE IV

Fig. 1. *Nannopterum harrisi* and nest (pp. 80–84). Albemarle Island; April 16, 1906.

Fig. 2. *Nannopterum harrisi* and nest (pp. 80–84). Albemarle Island; April 16, 1906.

EXPLANATION OF PLATE V

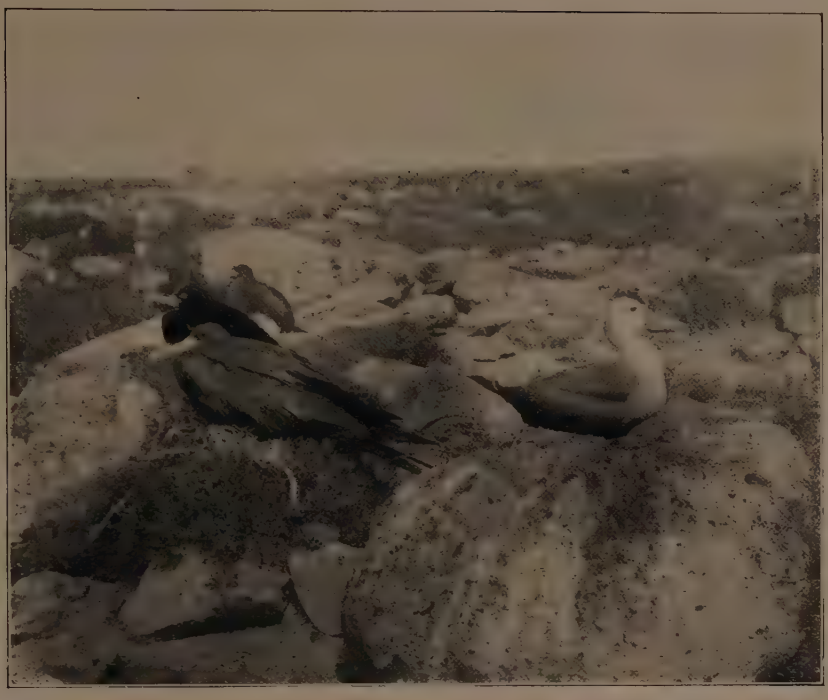
Fig. 1. *Sula piscatrix* (pp. 85–89). Tower Island.

Fig. 2. *Sula nebouxi* on nest (pp. 93–97). Hood Island; October 1, 1906.

## EXPLANATION OF PLATE VI

Fig. 1. *Fregata aquila* on nest (pp. 100–104). Hood Island; June 25, 1906.

Fig. 2. *Fregata aquila* on nest (pp. 100-104). Hood Island; June 25, 1906.



## EXPLANATION OF PLATE VII

Fig. 1. *Fregata aquila* (pp. 100–104). Hood Island.

Fig. 2. *Fregata aquila* (pp. 100–104). Tower Island; September 14, 1906.

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# Expedition of the California Academy of Sciences to the Galapagos Islands, 1905-1906

## IX

## The Galapagoan Lizards of the Genus Tropidurus; with Notes on the Iguanas of the Genera Conolophus and Amblyrhynchus

BY
JOHN VAN DENBURGH
*Curator of the Department of Herpetology*
AND
JOSEPH R. SLEVIN
*Assistant Curator of the Department of Herpetology*

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BY JOHN VAN DENBURGH

*Curator of the Department of Herpetology*

AND JOSEPH R. SLEVIN

*Assistant Curator of the Department of Herpetology*

CONTENTS

| | PAGE |
|---|---|
| INTRODUCTION: | |
| PREFATORY REMARKS | 134 |
| PREVIOUS COLLECTIONS AND STUDIES | 135 |
| LIST OF NAMES PROPOSED | 137 |
| RELATIONS AND LIST OF KINDS RECOGNIZED | 138 |
| ORIGIN AND DISTRIBUTION OF GALAPAGOS *Tropiduri* | 139 |
| ORIGIN AND HISTORY OF GALAPAGOS ISLANDS | 140 |
| SYSTEMATIC ACCOUNT: | |
| KEY TO THE SPECIES | 142 |
| *Tropidurus pacificus* | 143 |
| *Tropidurus duncanensis* | 147 |
| *Tropidurus habelii* | 150 |
| *Tropidurus bivittatus* | 155 |
| *Tropidurus delanonis* | 159 |
| *Tropidurus grayii* | 164 |
| *Tropidurus albemarlensis barringtonensis* | 168 |
| *Tropidurus albemarlensis* | 172 |
| *Conolophus subcristatus* | 188 |
| *Conolophus pallidus* | 190 |
| *Amblyrhynchus cristatus* | 192 |

September 17, 1913

# INTRODUCTION

## PREFATORY REMARKS

In two previous papers by the senior author the Snakes and the Geckos of the Galapagos Archipelago have been studied, and an attempt has been made to trace the history of these islands from the evidence afforded by these two groups of their reptilian inhabitants. It is now proposed to publish the results of a similar investigation of the lizards of the genus *Tropidurus*—an investigation undertaken for the purpose of confirming or disproving the conclusions reached through study of the Snakes and Geckos.

The material upon which this paper is based consists of more than two thousand specimens from twenty-four islands. The study of this collection has been an enormous task. Many of the differences between species are differences in the size and number of the scales. To show as clearly as possible all differentiation along these lines, the scales around the middle of the body, along the back, and along the belly have been counted in fifteen hundred specimens, and the counts have been charted island by island. This has involved the counting of more than a quarter of a million scales. These counts have all been made by Mr. Slevin in the following manner: 1. Scale-rows—The number of rows of scales around the body counted about midway between the fore and the hind limbs. 2. Crest—The number of scales in the crest-row from the point where the crest begins back to a line drawn across the back at the level of the anterior surfaces of the thighs, the thighs being held at right angles to the main axis of the body. 3. Belly—The scales in a row along the middle of the belly are counted from a line joining the anterior surfaces of the arms when the fore limbs are held at right angles to the main axis of the body, back to the anus. All measurements given are in millimeters. All specimens are in the collection of the Academy, and the numbers attached to them refer to the catalogue of specimens of the Department of Herpetology. Field notes and descriptions of the coloration of living specimens are in part by Mr. Slevin, and in part are quoted from Heller's paper on the reptiles of the archipelago. While the specimens are recorded as males and females, this determination of sex

rests only upon external characters. The internal organs have not been examined.

The Galapagos lizards of the genus *Tropidurus* have been much better known than any of the other reptiles of the archipelago. This is due chiefly to the studies of the late Dr. George Baur, from whose writings we shall quote.

## Previous Collections and Studies

The presence of lizards in these islands probably was recorded first by Amasa Delano in *A Narrative of Voyages and Travels* published in Boston in 1817. He mentioned the land "guana," the sea "guana," and lizards.

> The largest kind of lizards found here resembles the land guana in everything except size; they being only a little more than half the length. Their color and coarse appearance are the same with exception of a bright vermilion red throat; which makes it appear as if bloody. There are to be found there also two smaller kinds of lizards. The smallest is not much larger than a man's finger. The size of the other kind is between the two. There is no particular difference in the shape of the three kinds, but the color of the two latter is gray.

Charles Darwin, in 1835, during the voyage of the "Beagle," collected the specimens upon which Thomas Bell, in 1843, based the first scientific description of a Galapagos *Tropidurus*. These specimens "were taken in Chatham Island and in Charles Island." They were named by Bell *Leiocephalus Grayii*.

In 1851, Duméril recorded, under the name *Holotropis Grayii*, some Galapagos specimens without definite locality labels, which were collected during the visit of the "Vénus."

Dr. Kinberg, during the voyage of the "Eugenie," secured lizards on Chatham, Charles and Albemarle islands. Dr. Peters, in 1871, described the Chatham specimen as a new species, *Craniopeltis bivittata;* and recorded the Charles and Albemarle examples under the name *Craniopeltis Grayii*.

In 1872, Dr. Steindachner visited the Galapagos in connection with Louis Agassiz and the "Hassler" expedition. He observed these lizards on Albemarle, Indefatigable, James, and Jervis islands. Four years later Dr. Steindachner published an account of the lizards and snakes of the Galapagos islands. Dr. Habel, in 1868, had collected some lizards on "Indefatigable [?] and Bindloe" islands. These were described by Dr. Steindachner, as *Tropidurus (Craniopeltis) pacificus* and

*T. pacificus* (var. *Habelii*). *Craniopeltis bivittata* Peters was regarded as a synonym of *Tropidurus (Craniopeltis) Grayii,* which was said to occur on Chatham, Charles, Albemarle, James, Indefatigable, and Jervis islands.

In 1877, Dr. Günther recorded the specimens secured by Cookson, during the visit of the "Peterel." The Albemarle lizards were regarded as *Liocephalus Grayii* (Bell), while those from Abingdon were referred both to this species and to *L. pacificus* (Steind.). Steindachner was followed in regarding *Craniopeltis bivittata* Peters as a synonym of *L. Grayii.*

Boulenger in his Catalogue of Lizards, 1885, accepted the views of Günther, but placed these lizards in the genus *Tropidurus.*

In reporting upon the collections made by the "Albatross" in 1887–88, Professor Cope, in 1889, recorded *Tropidurus grayi* from James, Gardner, Hood, Indefatigable, Albemarle, and Duncan islands. The Duncan specimens were mentioned as a variety with a dark lateral band not very distinct. Specimens from Abingdon were referred to *Tropidurus pacificus,* while those from Chatham were described as a new species, *Tropidurus lemniscatus.*

The following year, Dr. George Baur studied these specimens collected by the "Albatross," one hundred and twenty-eight in number, and published his conclusion that nearly every island has its peculiar variety or species of *Tropidurus,* and no island has more than one kind. He described five new species, and stated the distribution of *Tropidurus,* in the archipelago to be as follows:

| | |
|---|---|
| *Tropidurus Grayii* Bell | Charles Island |
| " *lemniscatus* Cope | Chatham Island |
| " *pacificus* Steindachner | Bindloe Island |
| " *Delanonis* Baur | Hood and Gardner islands |
| " *Albemarlensis* Baur | Albemarle Island |
| " *indefatigabilis* Baur | Indefatigable and James islands |
| " *Duncanensis* Baur | Duncan Island |
| " *Abingdonensis* Baur | Abingdon Island |

The name *Tropidurus Delanonis* was changed in the reprints to *T. Hoodensis.*

Dr. Boulenger reviewed the subject in 1891, and concluded that *Craniopeltis bivitta* Peters differed from *Leiocephalus Grayii* Bell; that *Tropidurus lemniscatus* Cope is a synonym of *Craniopeltis bivittata* Peters; that *T. habelii* and *T. abingdonii*

are synonyms of *T. pacificus;* and that Baur's other new species were not worthy of separation from *T. grayii.*

During 1891, Dr. Baur visited the Galapagos Archipelago, and made large collections. His final study of the genus *Tropidurus* was published in 1892 in the *Festschrift für Leuckart.* In this article Dr. Baur recognizes the following species of *Tropidurus* from the Galapagos Islands:

| | | |
|---|---|---|
| 1. *Tropidurus Grayii* Bell | | Charles Island |
| 2. " | *Barringtonensis* new species | Barrington Island |
| 3. " | *indefatigabilis* Baur | Indefatigable Island |
| 4. " | *Jacobii* new species | James and Jervis islands |
| 5. " | *Albemarlensis* Baur | Albemarle Island |
| 6. " | *Delanonis* Baur | Hood and Gardner islands |
| 7. " | *Duncanensis* Baur | Duncan Island |
| 8. " | *pacificus* Steindachner | Abingdon Island |
| 9. " | *Habelii* Steindachner | Bindloe Island |
| 10. " | *bivittatus* Peters | Chatham Island |

The Hopkins-Stanford Galapagos Expedition secured large series of these lizards, which were studied by Edmund Heller. His paper, published in 1903, is the most recent review of the subject. Heller had no specimens from Charles Island. He recognized eight forms, as follows:

| | |
|---|---|
| *T. grayi grayi* Bell | Charles, Indefatigable, James, Jervis, and Albemarle islands |
| *T. grayi magnus* new subspecies | Narborough Island |
| *T. grayi barringtonensis* (Baur) | Barrington Island |
| *T. duncanensis* Baur | Duncan Island |
| *T delanonis* Baur | Hood Island and Gardner-near-Hood |
| *T. bivittatus* (Peters) | Chatham Island |
| *T. habeli* (Steindachner) | Bindloe Island |
| *T. pacificus* Steindachner | Abingdon Island |

## List of Names Proposed

The following is believed to be a complete list of the names proposed for Galapagos lizards of the genus *Tropidurus,* with their dates and type-localities:

| | |
|---|---|
| 1843 *T. grayii* (Bell) | Charles Island |
| 1871 *T. bivittatus* (Peters) | Chatham Island |
| 1876 *T. pacificus* Steindachner | Abingdon Island |
| 1876 *T. habelii* (Steindachner) | Bindloe Island |
| 1889 *T. lemniscatus* Cope | Chatham Island |
| 1890 *T. delanonis* Baur | Hood Island |
| 1890 *T. albemarlensis* Baur | Tagus Cove, Albemarle Island |

| | |
|---|---|
| 1890 *T. indefatigabilis* Baur | Indefatigable Island |
| 1890 *T. duncanensis* Baur | Duncan Island |
| 1890 *T. abingdonensis* Baur | Abingdon Island |
| 1890 *T. hoodensis* Baur | Hood Island |
| 1892 *T. barringtonensis* Baur | Barrington Island |
| 1892 *T. jacobii* Baur | James Island |
| 1903 *T. grayi magnus* Heller | Narborough Island |

*T. hoodensis* is merely a substitute name. *T. lemniscatus* is a synonym of *T. bivittatus,* as *T. abingdonensis* is of *T. pacificus.* Thus we have left eleven names, which have been given to the lizards of as many different islands. How many of these are entitled to recognition?

## RELATIONS AND LIST OF KINDS RECOGNIZED

There can be no doubt that Baur was right in his belief that only one kind of *Tropidurus* occurs on any one island. It is true also that many of the islands have distinct and peculiar forms of *Tropidurus.* But when we come to study these lizards we find that differentiation has proceeded much farther upon some islands than upon others. The most distinct of all are the Abingdon, Bindloe, Duncan, and Chatham lizards. There can be no doubt that they should be regarded as four species. The next in point of distinctness is the Hood Island form. Then comes the Charles Island lizard, which in certain characters resembles that of Hood, while in others it is more like that of Barrington. The last mentioned (Barrington form) stands next as a sort of connecting link between the lizards of Hood and Charles islands on the one hand, and its still closer relatives of the central and western islands, as yet unmentioned, on the other. The lizards of these three islands (Hood, Charles and Barrington) certainly are distinct, but there easily may be some difference of opinion as to whether they should rank as full species or as subspecies. The *Tropiduri* of Indefatigable, James, Jervis, Albemarle, and Narborough islands are most closely related. Very large series enable us to show that the lizards of these islands are not absolutely identical, but differentiation is as yet so slight that it seems best to use but one name for all.

We, therefore, shall describe the *Tropiduri* of the Galapagos Islands under the following names:

| | |
|---|---|
| 1. *T. pacificus* | Abingdon Island |
| 2. *T. duncanensis* | Duncan Island |
| 3. *T. habelii* | Bindloe Island |
| 4. *T. bivittatus* | Chatham Island |
| 5. *T. delanonis* | Hood and Gardner islands |
| 6. *T. grayii* | Charles, Gardner, Champion, and Enderby islands |
| 7. *T. albemarlensis barringtonensis* | Barrington Island |
| 8. *T. albemarlensis* | Indefatigable, S. Seymour, N. Seymour, Daphne, James, Jervis, Cowley, Brattle, Albemarle, and Narborough islands |

## ORIGIN OF THE GALAPAGOS LIZARDS OF THE GENUS TROPIDURUS

The genus *Tropidurus,* as at present understood, is confined to the Galapagos Archipelago and South America. It has been reported from Paraguay, Argentine, Chile, Bolivia, Peru, Equador, Brazil, Dutch Guiana, and Venezuela. The closely allied genus *Leiocephalus* occurs in Bolivia, Peru, Equador, Colombia, Brazil, the Greater and Lesser Antilles and the Bahamas. It is evident, therefore, that the affinities of these Galapagos lizards are South American and West Indian. Either the lizards of the Galapagos have been derived from South America, or those of both localities have common ancestors.

In the Galapagos Archipelago, *Tropiduri* occur on almost every island, islet, and rock. The notable exceptions are Culpepper, Wenman, and Tower islands. They have been found on Abingdon, Bindloe, Chatham, Hood, Gardner-near-Hood, Charles, Enderby, Champion, Gardner-near-Charles, Barrington, Indefatigable, North and South Seymour, Daphne, James, Bartholomew, Jervis, Duncan, Cowley, Brattle, Albemarle, and Narborough islands.

The fact that these lizards occur on nearly every island of the archipelago can be explained only in one of two ways. These *Tropiduri* must have reached these islands either by land or by water. Either they have been carried to each island, islet, and rock by some such means of dispersal as floating driftwood driven by the winds and currents, or else they were already on each island at the time when it became separated from a larger land-mass. The former view has been held by those who believe that these islands never have been connected, but have been independently thrust above the surface of the ocean. The latter explanation finds favor with

those who believe that these islands all formerly were connected, and formed part of a single large island which, sometime, must have been connected with continental America.

We can see but little to commend the former view, for the means of dispersal from continent to island or from island to island over the intervening water must, in the nature of things, be but accidental or occasional, and must seem quite inadequate to account for the wide distribution of these lizards in the archipelago. Again, Wenman and Culpepper islands lie directly in the path of the currents from the other islands, yet both are without *Tropiduri.* Furthermore, were such means of dispersal sufficient to bring about the wide distribution of these reptiles, we must believe that the interchange of lizards between the islands would result either in preventing differentiation on the various islands, or in the transportation of differentiated races from island to island. Thus we should expect to find either one kind of lizard on all the islands, or a tendency toward the distribution of all kinds of lizards to each island. But many of the islands have each its peculiar kind of *Tropidurus,* and no island has more than one kind. Even in the case of Duncan Island, almost surrounded as it is by other close-lying islands, the evidence all points to complete isolation during a long period of time.

## Origin and History of the Galapagos Islands

We, therefore, adopt the other theory: that there formerly was a single large island inhabited by one species of *Tropidurus;* that through partial and gradual submersion this island became divided into the many islands of the present archipelago; that each island after its separation was occupied by those animals which inhabited it before; and that the present fauna of each island is directly descended from its original inhabitants.

It is probable that the separation of the various islands occurred at different times rather than simultaneously.

If it be admitted that the degree of differentiation in a single group, under conditions such as obtain in these islands, may be regarded as an index to the period of isolation, we may proceed to sketch the history of the archipelago as indicated by the lizards of this genus.

The *Tropiduri* of Abingdon, Bindloe, Duncan, and Chatham islands show the greatest differentiation. Accordingly, we may believe that these islands early became separated from each other and from the remaining portions of the group, and have maintained independent existence ever since.

The next lizard, in point of distinctness, is that of Hood Island. Hence it would seem probable that this southern island was the one next separated. The closest relationship of this *Tropidurus* seems to be with that of Charles Island. This relationship is not nearly so striking as in the case of the snakes and geckos of these two islands, but it nevertheless may be interpreted as indicating some connection between these islands in the past, probably subsequent to their separation from the rest of the archipelago.

The *Tropidurus* of Gardner-near-Hood appears to be identical with that of the main island, so that the separation of this islet from Hood doubtless is of recent date.

The Charles Island lizard is, in a sense, intermediate between those of Hood and Barrington islands. This apparent relationship with the Barrington form inclines one to believe that the former connection of the Hood-Charles island with the remainder of the archipelago may have been by way of Barrington.

The lizards of Enderby, Champion, and Gardner-near-Charles do not differ from those of the larger island. The separation of these islets from Charles Island, therefore, may be regarded as having occurred much later than the separation of Charles from Hood.

Barrington Island probably was the next to assume an independent existence.

The lizards of the remaining islands—Indefatigable, the Seymours, Daphne, James, Jervis, Cowley, Brattle, Albemarle and Narborough—show so little differentiation that we are led to the conclusion that all of these islands were connected, and formed a single large island for some time after the separation of Barrington. It is probable that a large bay extended from the south toward the center of this island, completely surrounding Duncan Island with water.

The history of this large central island cannot be clearly traced farther from evidence afforded by the *Tropiduri.*

Nevertheless, the examination of very large series discloses certain average differences, and certain resemblances, which lead us to believe that, during a considerable period of time after this large island was broken up, Narborough Island remained connected with Albemarle, as did James with Jervis, and Indefatigable with the Seymours. Brattle and Cowley islands doubtless were joined to Albemarle, and Bartholomew to James. Curiously enough, the *Tropiduri* of Daphne Island seem to resemble those of James Island more closely than they do those of the Seymours and Indefatigable, although the latter lie much nearer.

Thus we find that the evidence gathered from a study of the *Tropiduri* points to the gradual depression and partial submersion of a former Galapagos Land, resulting in its division into many smaller islands and islets. The story agrees in almost every detail with that which we have previously gathered from an investigation of the snakes and geckos. The chief points of difference are that the snake of Barrington is less differentiated than the lizard, and the *Tropiduri* afford less evidence than do the snakes of a former division into an Albemarle–Narborough Island and a James–Jervis–Indefatigable Island.

## SYSTEMATIC ACCOUNT

### KEY TO THE GALAPAGOS TROPIDURI

a.—Sides of neck scaly, with fewer folds.
b.—Scales around body not more than 65; males longitudinally striped. Chatham.
**T. bivittatus.**—p.
b.²—Scales around body more than 65; no longitudinal stripes. Bindloe.
**T. habelii.**—p.
a.²—Sides of neck granular between folds; folds more numerous.
bb.—Hind legs of males with definite blackish spots; interparietal plate seldom much broader than long; scales around body not more than 80.
c.—36 to 48 scales in crest; smaller; little red in coloring. Charles.
**T. grayii.**—p.
c.²—50 to 61 scales in crest; larger; usually much red. Hood.
**T. delanonis.**—p.
bb.—Hind legs without definite blackish spots; interparietal usually much broader than long; or scales around body more than 80.
cc.—Scales around body more than 75.
d.—Head above speckled with lighter spots; no red in general coloration; scales around body 85 to 101. Abingdon.

**T. pacificus.**—p

d.²—Head not speckled above; more or less suffused with red; scales around body 76 to 92. Duncan.

**T. duncanensis.**—p.

cc.²—Scales around body fewer than 76.

dd.—Scales smaller, 61 to 76 around body. Barrington.

**T. albemarlensis barringtonensis.**—p.

dd.³—Scales larger, 50 to 69 around body. Indefatigable, James, Jervis, Albemarle, Narborough, etc.

**T. albemarlensis.**—p.

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## Tropidurus pacificus Steindachner

Abingdon Island Lizard

1876, *Tropidurus* (*Craniopeltis*) *pacificus*, STEINDACHNER, Festschrift Zool-Bot. Ges. Wien, 1876, p. 313, pl. II, fig. 3 (type locality **Indefatigable** [?] and **Bindloe Islands, Galapagos Archipelago).**

1877, *Liocephalus pacificus*, GÜNTHER, Proc. Zool. Soc. Lond., 1877, p. 67 (part).

1885, *Tropidurus pacificus*, BOULENGER, Cat. Lizards Brit. Mus., II, 1885, p. 173; COPE, Proc. U. S. Nat. Mus., XII, 1889, p. 147; BOULENGER, Ann. and Mag. Nat. Hist., (6), VII, p. 501 (part); BAUR, Festschrift für Leuckart, 1892, p. 270; HELLER, Proc. Washington Acad. Sci., V. 1903, p. 83.

1890. *Tropidurus abingdonii*, BAUR, Biol. Centralbl., X, 1890, p. 479 (type locality Abingdon Island, Galapagos).

*Diagnosis.*—Sides of neck with numerous folds; skin between neck-folds granular; hind legs without definite blackish spots; interparietal usually much broader than long; 83 to 101 scales around middle of body; top of head mottled or speckled with light color; a middorsal light streak in males.

*Type.*—Vienna Museum. Collected by Dr. Habel on **"Indefatigable** [?] and **Bindloe Islands," Galapagos Archipelago.** Specimens with the high scale counts given by Dr. Steindachner, however, could only have come from Abingdon.

*Distribution.*—This species occurs only on Abingdon Island, Galapagos Archipelago.

*Material.*—The Academy's collection contains about one hundred and fifty specimens, of which fifty-seven males and sixty-five females have been included in the scale counts.

*Description of adult male, No. 12587.*—The head is covered above with smooth scales; interparietal largest, broader than long; five or six large supraoculars; superciliaries imbricate; five superior and five inferior labials to below middle of eye; rostral very broad and low; symphyseal broad, followed by a series of large sublabials, of which all but the first are separated from the infralabials by a row of smaller plates. Ear-opening large, with an anterior denticulation of five or six long, narrow scales. Side of neck between ear-opening and fore limb with numerous folds, covered with granular scales. A strong antehumeral, but no complete gular, fold. A well-developed medium dorsal crest begins half the length of the interparietal behind this plate, and runs continuously to and along the tail, being highest on the proximal fourth of the tail. The dorsal regions of the neck, body, and tail are covered with rather small, keeled, mucronate scales, which, on the body, change gradually to smaller,

keeled, mucronate laterals. These again change gradually into the smooth ventrals, which are a little smaller than the dorsals. The gular scales are smooth, smaller posteriorly, smallest below the ears. The scales on the chest are largest, smooth, and imbricate. The limbs are provided above with keeled, and below with smooth, scales. The posterior surface of the thigh is covered with smooth sub-granular scales, between which smaller granules may often be seen. The lateral caudals are strongly keeled and mucronate, while the inferior caudals are smooth proximally, but become keeled on the distal portion of the tail.

The general coloration in alcohol is grayish brown, spotted with black on the fore limbs, back, and sides of neck and body, temples, chin, throat and chest. These black markings tend to form vertical bars on the neck and anterior dorsal region. There is an antehumeral black blotch, and the posterior gular region is mostly black. The head, neck, body, limbs, and tail are speckled with light bluish gray, and a band of the same color runs along the median dorsal region. The hind limbs are not distinctly spotted with black.

| | |
|---|---|
| Length to anus ..... mm. | 100 |
| Length of tail ..... | 143+ |
| Snout to ear ..... | 22 |
| Width of head ..... | 17 |
| Fore limb ..... | 45 |
| Hind limb ..... | 69 |
| Base of fifth to end of fourth toe ..... | 25 |
| Height of crest on nape ..... | 1.2 |
| Height of crest on midbody ..... | 1.2 |
| Height of crest on tail ..... | 2.3 |

*Coloration in life of adult male.*—Dorsum grayish brown; the back crossed by several series of transverse black bars, most distinct anteriorly, interrupted medially and on sides. Dorsal crest and the scales at its base light greenish gray; dorsum, tail, and limbs spotted with same. Top of head reddish brown, nape olive brown. Fore limbs brownish, barred above like the back. Tail becoming dusky toward tip, without lighter spots. Chin and sides of mandible pinkish; throat deep brown; chest light brown, dark-spotted, the scales with light margins; fore limbs below like the chest, slightly more buffy. Belly, hind limbs, and tail inferiorly light olive gray. Sides of head from snout to ear-opening red, shading into seal brown on the neck. A black antehumeral spot. Sides of body reddish, black-spotted.

*Coloration in life of adult female.*—Whole, head, nape, shoulders, back anteriorly, and sides of body brick red; fore limbs reddish, becoming olive gray distally. Dorsal crest and median line of back greenish gray; dorsum from middle of back, tail, and hind limbs above olive brown, spotted with the color of the dorsal crest. Belly, tail, and hind limbs inferiorly light olive gray. Breast and sides of body light brick red; throat dark red; lower jaw light like the breast. Fore limbs below

brick red proximally, lighter grayish distally. Antehumeral spot black.

*Variation.*—There is much variation in the size, number and arrangement of the head scales. The characteristic coloration in the males is fairly constant. Females show few or no black markings, though traces of them may often be made out as spots of brown darker than the ground color. The belly usually is slaty or bluish gray, sometimes yellowish. Many females have the head and sides of neck suffused with brick red. The number of scales around the middle of the body varies from 83 to 101; in the crest from 46 to 61; and along the belly from 70 to 85. Variation in these respects will be found in the following:

TABLE OF SCALE COUNTS—ABINGDON ISLAND

| Number | Sex | Scale Rows | Crest | Belly | Number | Sex | Scale Rows | Crest | Belly |
|---|---|---|---|---|---|---|---|---|---|
| 12475 | ♂ | 88 | 54 | 81 | 12476 | ♀ | 86 | 47 | 80 |
| 12477 | ♂ | 86 | 51 | 78 | 12478 | ♀ | 88 | 59 | 78 |
| 12479 | ♂ | 89 | .. | 79 | 12481 | ♀ | 87 | 53 | 84 |
| 12480 | ♂ | 86 | 58 | 82 | 12484 | ♀ | 87 | 55 | 83 |
| 12482 | ♂ | 88 | 57 | 83 | 12511 | ♀ | 92 | 54 | 79 |
| 12483 | ♂ | 97 | 55 | 81 | 12512 | ♀ | 90 | 56 | 78 |
| 12485 | ♂ | 86 | 56 | 85 | 12513 | ♀ | 90 | 58 | 79 |
| 12486 | ♂ | 93 | 57 | 79 | 12514 | ♀ | 90 | 48 | 74 |
| 12487 | ♂ | 85 | .. | 77 | 12515 | ♀ | 88 | 47 | 70 |
| 12488 | ♂ | 92 | 55 | 83 | 12516 | ♀ | 89 | 59 | 80 |
| 12489 | ♂ | 86 | 54 | 79 | 12517 | ♀ | 88 | 56 | 81 |
| 12490 | ♂ | 90 | 55 | 83 | 12518 | ♀ | 97 | 60 | 83 |
| 12491 | ♂ | 88 | 56 | 81 | 12519 | ♀ | 95 | 61 | 82 |
| 12492 | ♂ | 96 | 54 | 80 | 12520 | ♀ | 87 | 60 | 79 |
| 12493 | ♂ | 93 | 52 | 77 | 12521 | ♀ | 88 | 53 | 74 |
| 12494 | ♂ | 90 | .. | 74 | 12522 | ♀ | 91 | 58 | 78 |
| 12495 | ♂ | 87 | 57 | 83 | 12523 | ♀ | 88 | 57 | 82 |
| 12496 | ♂ | 90 | .. | 83 | 12524 | ♀ | 90 | 61 | 76 |
| 12497 | ♂ | 88 | 53 | 79 | 12525 | ♀ | 88 | 58 | 75 |
| 12498 | ♂ | 91 | 57 | 76 | 12526 | ♀ | 88 | 55 | 75 |
| 12500 | ♂ | 93 | 54 | 83 | 12527 | ♀ | 88 | 53 | 74 |
| 12501 | ♂ | 91 | 51 | 77 | 12528 | ♀ | 97 | 60 | 83 |
| 12502 | ♂ | 88 | 58 | 78 | 12529 | ♀ | 97 | 61 | 80 |
| 12503 | ♂ | 91 | .. | 79 | 12530 | ♀ | 96 | 59 | 77 |
| 12504 | ♂ | 92 | 51 | 82 | 12531 | ♀ | 93 | 52 | 75 |
| 12505 | ♂ | 96 | 46 | 83 | 12532 | ♀ | 86 | 56 | 79 |
| 12506 | ♂ | 95 | 49 | 81 | 12533 | ♀ | 89 | 60 | 83 |
| 12507 | ♂ | 93 | 51 | 80 | 12534 | ♀ | 94 | 57 | 77 |
| 12508 | ♂ | 97 | 55 | 79 | 12536 | ♀ | 92 | 58 | 78 |
| 12509 | ♂ | 91 | 52 | 80 | 12537 | ♀ | 86 | 54 | 82 |
| 12585 | ♂ | 89 | .. | 85 | 12538 | ♀ | 94 | 59 | 79 |
| 12586 | ♂ | 91 | 54 | 79 | 12540 | ♀ | 93 | 59 | 82 |
| 12587 | ♂ | 90 | 56 | 85 | 12541 | ♀ | 91 | 60 | 82 |
| 12588 | ♂ | 89 | 56 | 85 | 12542 | ♀ | 90 | 59 | 78 |
| 12589 | ♂ | 93 | 51 | 79 | 12543 | ♀ | 91 | 53 | 77 |
| 12590 | ♂ | 85 | .. | 77 | 12544 | ♀ | 86 | 54 | 71 |
| 12591 | ♂ | 88 | 58 | 83 | 12545 | ♀ | 87 | 54 | 82 |

TABLE OF SCALE COUNTS—ABINGDON ISLAND—*Continued*

| Number | Sex | Scale Rows | Crest | Belly | Number | Sex | Scale Rows | Crest | Belly |
|---|---|---|---|---|---|---|---|---|---|
| 12593 | ♂ | 91 | 54 | 85 | 12594 | ♀ | 88 | 52 | 80 |
| 12598 | ♂ | 91 | 54 | 82 | 12596 | ♀ | 86 | .. | 74 |
| 12600 | ♂ | 84 | 48 | 78 | 12597 | ♀ | 90 | 52 | 74 |
| 12604 | ♂ | 87 | 52 | 82 | 12599 | ♀ | 84 | 53 | 79 |
| 12605 | ♂ | 87 | 58 | 81 | 12603 | ♀ | 94 | 54 | 78 |
| 12606 | ♂ | 90 | 53 | 83 | 12609 | ♀ | 92 | 55 | 80 |
| 12608 | ♂ | 90 | 55 | 83 | 12611 | ♀ | 92 | 51 | 84 |
| 12610 | ♂ | 89 | 54 | 83 | 12615 | ♀ | 84 | 52 | 79 |
| 12612 | ♂ | 88 | 55 | 83 | 12617 | ♀ | 88 | 55 | 80 |
| 12613 | ♂ | 92 | 53 | 83 | 12618 | ♀ | 83 | .. | 76 |
| 12614 | ♂ | 90 | 55 | 83 | 12619 | ♀ | 90 | 56 | 80 |
| 12616 | ♂ | 91 | 58 | 83 | 12620 | ♀ | 91 | .. | 80 |
| 12622 | ♂ | 90 | 57 | 79 | 12621 | ♀ | 88 | 57 | 77 |
| 12626 | ♂ | 86 | 53 | 81 | 12623 | ♀ | 86 | 55 | 77 |
| 12627 | ♂ | 88 | 54 | 80 | 12624 | ♀ | 89 | 58 | 76 |
| 12628 | ♂ | 90 | 58 | .. | 12632 | ♀ | 85 | 56 | 74 |
| 12629 | ♂ | 90 | .. | 78 | 12633 | ♀ | 83 | 55 | 76 |
| 12630 | ♂ | 87 | 55 | 76 | 12634 | ♀ | 87 | 56 | 80 |
| 12631 | ♂ | 91 | 55 | 79 | 12636 | ♀ | 92 | 56 | 78 |
| 12640 | ♂ | 85 | .. | 75 | 12637 | ♀ | 95 | 56 | 82 |
| | | | | | 12638 | ♀ | 90 | 56 | 77 |
| | | | | | 12644 | ♀ | 89 | 51 | 74 |
| | | | | | 12645 | ♀ | 91 | 56 | 79 |
| | | | | | 12646 | ♀ | 84 | 55 | 76 |
| | | | | | 12647 | ♀ | 89 | 54 | 78 |
| | | | | | 12649 | ♀ | 90 | 56 | 80 |
| | | | | | 12652 | ♀ | 93 | 53 | 84 |
| | | | | | 12653 | ♀ | 88 | 58 | 77 |

*Habits.*—Abingdon Island, Sept. 18 and 22, 1906. Went ashore on the south side of the island. Landed on a good sand beach and worked inland about a mile. About half way up the mountain a distinct green zone is plainly visible, while the lower part is brown lava, not very rough, and covered sparingly with cactus and trees. The lizards are abundant in this lower portion, especially near the beach, which swarms with seal-flies. Several stomachs examined contained these flies and the leaves of a succulent plant which grows on the beach. Lizards are most abundant near the beach, but their range extends up to 1500 feet, where they are rather scarce.

"The food is chiefly vegetable, varied with insects, etc. Stomachs examined contained berries, hard seeds, and blossoms, with an occasional grasshopper, beetle or other insect. The seed capsules and berries are eaten for the fleshy part surrounding the seeds, which is the only part digested, the seeds passing unchanged through the alimentary canal." (Heller.)

*General remarks.*—The Abingdon Island *Tropidurus* is a very distinct species. It has smaller scales than any other species found in the archipelago. In scale characters it most resembles the species of Duncan Island, but has rather smaller scales and a very different coloration. The peculiar light speckling of the upper surfaces, and particularly of the head, seems to be quite characteristic, and is shown by both sexes.

### **Tropidurus duncanensis** Baur

Duncan Island Lizard

1889, *Tropidurus grayi*, Cope, Proc. U. S. Nat. Mus., XII, 1889, p. 145 (part); Boulenger, Ann. and Mag. Nat. Hist., (6), VII, 1891, p. 502 (part).

1890, *Tropidurus duncanensis*, Baur, Biol. Centralbl., X, 1890, p. 479 (type locality Duncan Island Galapagos Archipelago); Baur, Festschrift für Leuckart, 1892, p. 270; Heller, Proc. Washington Acad. Sci., V, 1903, p. 77.

*Diagnosis.*—Sides of neck with numerous folds; skin between neck folds granular; hind legs without definite blackish spots; interparietal usually much broader than long; 76 to 92 scales around middle of body; top of head unicolor; no middorsal streak; often much red in coloration.

*Types.*—U. S. National Museum Nos. 14941 to 14944. Collected by the U. S. Fish Commission Steamer "Albatross," on **Duncan Island, Galapagos Archipelago,** between April 4 and 16, 1888.

*Distribution.*—Duncan Island, Galapagos Archipelago.

*Material.*—The Academy collection contains about one hundred specimens, of which thirty-nine males and forty-eight females have been included in the scale counts.

*Description of adult male No. 12203.*—The head is covered above with smooth scales; interparietal largest, broader than long; four or five superior and as many inferior labials, to below middle of eye; rostral very broad and low; symphyseal much narrower, followed by a series of large sublabials, of which all but the first are separated from the infralabials by a row of somewhat smaller plates. Ear-opening large, with an anterior denticulation of six or eight long, slender scales. Side of neck between ear-opening and fore limb with numerous folds, covered with granular scales. A strong antehumeral, but no complete gular, fold. A well-developed median dorsal crest begins four scales behind the interparietal, and runs continuously to and along the tail, being highest on the proximal third of the tail, and absent toward its tip. The dorsal regions of the neck, body, and tail are covered with rather small, keeled, mucronate scales, which, on the body, change gradually to smaller, keeled, mucronate laterals. These again change gradually into the smooth ventrals, which are much smaller than the dorsals. The gular scales are smooth, smaller posteriorly, smallest below the ear. The scales on the chest are about as large as the dorsals, smooth and imbricate. The limbs are provided above

with keeled, and below with smooth, scales. The posterior surface of the thigh is covered with imbricate scales, a few of which are keeled. The lateral caudals are strongly keeled and mucronate, while the inferior caudals are smooth proximally, but become keeled on the distal portion of the tail.

The general coloration in alcohol is grayish brown, with very small scattered black spots on the body, neck, and fore limbs. Some larger black spots on chest and throat, the center of which is dark blackish brown. No vertical dark blotches or distinct rounded spots or light medium band on back. There is a black antehumeral blotch. The top and sides of the head are dark olive brown, unicolor. The hind limbs and tail are lighter olive brown, unspotted. The chest and center of belly are grayish white. The throat and sides of belly, head, and body are suffused with red.

| | | |
|---|---|---|
| Length to anus | mm. | 95 |
| Length of tail | | 132 |
| Snout to ear | | 19 |
| Width of head | | 15 |
| Fore limb | | 37 |
| Hind limb | | 64 |
| Base of fifth to end of fourth toe | | 25 |
| Height of crest on nape | | 1.1 |
| Height of crest on midbody | | 1 |
| Height of crest on tail | | 2 |

*Coloration in life of adult male.*—Above olive brown, black-spotted except the head; tail more brownish with few dark spots; hind limbs and tail light blue, gray-spotted; fore limbs dark-spotted like the back. Sides of head and body, from snout to tip of tail, brick red, finely black-spotted on sides and along the belly, where the red is brightest; a black antehumeral spot. Throat black; breast, mandible, and fore limbs reddish, black-spotted; chin, belly, hind limbs, and tail inferiorly red.

*Coloration in life of adult female.*—Above olive brown. Sides of head and body from snout to tip of tail brick red, darkest dorsally where the red extends high up and encroaches on the dorsum, brightest along the belly; a black antehumeral spot. Below red from mandible to tip of tail, darkest anteriorly on lower jaw, brightest on tail; breast and belly lighter, breast dark-spotted.

*Variation.*—Females have more of the red suffusion than the males, and show fewer black spots on the sides and back, and less black on the throat. In some females the red covers not only the lower surfaces of the belly, sides, and tail, but extends up on the back.

The head-scales are subject to considerable variation. The interoccipital is always very large, though it sometimes is only a little wider than long. There seems to be but little variation

in the keeling and arrangement of the body-scales. The range in scale counts is given in the following table:

TABLE OF SCALE COUNTS—DUNCAN ISLAND

| Number | Sex | Scale Rows | Crest | Belly | Number | Sex | Scale Rows | Crest | Belly |
|---|---|---|---|---|---|---|---|---|---|
| 10561 | ♂ | 76 | 55 | 84 | 12176 | ♀ | 76 | 53 | 82 |
| 10562 | ♂ | 89 | 57 | 86 | 12177 | ♀ | 84 | 52 | 91 |
| 10565 | ♂ | 82 | 53 | .. | 12178 | ♀ | 82 | 55 | 91 |
| 10566 | ♂ | 84 | 50 | 86 | 12183 | ♀ | 84 | 58 | 92 |
| 12172 | ♂ | 86 | 52 | 87 | 12185 | ♀ | 91 | .. | 89 |
| 12173 | ♂ | 81 | 50 | 80 | 12186 | ♀ | 89 | 55 | 90 |
| 12174 | ♂ | 91 | 59 | 88 | 12187 | ♀ | 80 | 53 | 82 |
| 12175 | ♂ | 82 | 57 | 86 | 12188 | ♀ | 85 | 59 | 86 |
| 12179 | ♂ | 92 | 49 | 88 | 12189 | ♀ | 80 | 55 | 82 |
| 12181 | ♂ | 85 | 51 | 86 | 12193 | ♀ | 80 | 56 | 85 |
| 12182 | ♂ | 82 | 53 | 87 | 12194 | ♀ | 84 | 54 | 90 |
| 12184 | ♂ | 92 | 53 | 84 | 12195 | ♀ | 82 | 55 | 87 |
| 12188 | ♂ | 79 | 51 | 80 | 12197 | ♀ | 80 | 56 | 81 |
| 12190 | ♂ | 76 | 54 | 87 | 12198 | ♀ | 79 | 52 | 83 |
| 12191 | ♂ | 81 | 55 | 89 | 12201 | ♀ | 82 | 52 | 85 |
| 12192 | ♂ | 86 | 56 | 88 | 12204 | ♀ | 82 | 52 | 86 |
| 12196 | ♂ | 86 | 53 | 90 | 12208 | ♀ | 87 | 57 | 90 |
| 12199 | ♂ | 81 | 56 | 87 | 12209 | ♀ | 79 | 56 | 87 |
| 12200 | ♂ | 84 | 53 | 87 | 12210 | ♀ | 84 | .. | 88 |
| 12202 | ♂ | 80 | 52 | 85 | 12212 | ♀ | 82 | 52 | 82 |
| 12203 | ♂ | 86 | 52 | 84 | 12218 | ♀ | 81 | 54 | 83 |
| 12205 | ♂ | 88 | 52 | 91 | 12219 | ♀ | 81 | 51 | 81 |
| 12206 | ♂ | 87 | 53 | 88 | 12220 | ♀ | 80 | .. | .. |
| 12207 | ♂ | 83 | 53 | 84 | 12225 | ♀ | 87 | 50 | 84 |
| 12217 | ♂ | 80 | 47 | 84 | 12226 | ♀ | 82 | 54 | 87 |
| 12221 | ♂ | 79 | 53 | 86 | 12227 | ♀ | 83 | 51 | 80 |
| 12222 | ♂ | 85 | 54 | 84 | 12228 | ♀ | 82 | 50 | 81 |
| 12223 | ♂ | 83 | 54 | 86 | 12229 | ♀ | 88 | 50 | 67 |
| 12224 | ♂ | 82 | 51 | 87 | 12230 | ♀ | 80 | 52 | 86 |
| 12235 | ♂ | 81 | 47 | 82 | 12231 | ♀ | 85 | 57 | 84 |
| 12239 | ♂ | 78 | 45 | 80 | 12232 | ♀ | 79 | 51 | 79 |
| 12241 | ♂ | 83 | 54 | 85 | 12233 | ♀ | 82 | 54 | 86 |
| 12243 | ♂ | 83 | .. | 86 | 12234 | ♀ | 80 | 51 | 78 |
| 12245 | ♂ | 89 | 53 | 80 | 12236 | ♀ | 81 | 53 | 85 |
| 12248 | ♂ | 81 | 51 | 83 | 12237 | ♀ | 80 | 50 | 84 |
| 12251 | ♂ | 84 | 52 | 83 | 12238 | ♀ | 80 | 50 | 81 |
| 12254 | ♂ | 82 | 52 | 86 | 12240 | ♀ | 79 | 54 | 87 |
| 12257 | ♂ | 84 | 44 | 82 | 12242 | ♀ | 81 | 54 | 86 |
| 12258 | ♂ | 83 | 46 | 82 | 12244 | ♀ | 81 | 51 | 80 |
| | | | | | 12246 | ♀ | 81 | 52 | 88 |
| | | | | | 12247 | ♀ | 80 | 54 | 87 |
| | | | | | 12249 | ♀ | 76 | 51 | 80 |
| | | | | | 12250 | ♀ | 80 | 53 | 79 |
| | | | | | 12252 | ♀ | 81 | 53 | 78 |
| | | | | | 12253 | ♀ | 79 | 54 | 80 |
| | | | | | 12256 | ♀ | 77 | 52 | 82 |
| | | | | | 12259 | ♀ | 84 | 58 | 84 |
| | | | | | 12260 | ♀ | 80 | 53 | 88 |

*Habits.*—Duncan Island, Dec. 11 to 16, 1905. Lizards were fairly common in the brushy portion. I have not been in the

crater as yet, but Mr. Beck says they were not more abundant there than elsewhere. Aug. 14, 1906. Went ashore after lizards. I found them by no means abundant—if anything rather scarce. I collected on the N.E. slope of the island to about 800 feet. The *Tropiduri* are very wild, and keep close under cover. They generally were found under the thorn bushes or on piles of old lava, under which they get on one's approach. Secured about thirty during the day. Aug. 15. Went down into the large crater at the north end of the island. The floor of the crater is 450 feet above sea-level and is composed of red loam covered with large thorn bushes and old stumps. The vegetation is thickest around the edges, while the central portion is almost bare. Lizards were the only reptiles seen, and were more plentiful there than elsewhere, but by no means abundant. The numerous hawks make them wilder than those of any other island where we have collected, except Charles Island. Some of the males have a rich salmon coloring, but I find little or no difference between those taken in the crater and those taken outside, although the color of their surroundings in the crater is quite red. In several stomachs examined I found portions of beetle wings and grasshoppers. The latter seem to form one of the principal articles of food, for I saw several lizards chasing them. I saw quite a number of young, and presume the breeding season has not been over very long.

"Their food consists exclusively of insects. The stomachs examined contained grasshoppers, caterpillars, grubs, beetles, etc." (Heller.)

*General remarks.*—The small size of its scales causes this species to bear a general resemblance to the *Tropidurus* of Abingdon Island. The coloration, however, is very different: the Duncan lizards are the reddest of the *Tropiduri*, while the Abingdon species is of a bluish-gray tone. The Duncan lizard does not show the speckled head so characteristic of the Abingdon form. The scales on the belly of Duncan specimens are smaller than in any other species.

### **Tropidurus habelii** (Steindachner)

Bindloe Island Lizard

1876, *Tropidurus pacificus* (var. *habelii*), STEINDACHNER, Festschrift Zool.-Bot. Ges. Wien, 1876, p. 314, pl. II, fig. 2 (type locality **Indefatigable** [?] and **Bindloe Islands, Galapagos Archipelago).**

1877, *Liocephalus pacificus*, GÜNTHER, Proc. Zool. Soc. Lond., 1877, p. 67 (part).

1890, *Tropidurus pacificus*, BAUR, Biol. Centralbl., X, 1890, p. 479; BOULENGER, Ann. and Mag. Nat. Hist., (6), VII, 1891, p. 501 (part).

1892, *Tropidurus habelii*, BAUR, Festschrift für Leuckart, 1892, p. 271; HELLER, Proc. Washington Acad. Sci., V. 1903, p. 81.

*Diagnosis.*—Neck folds fewer, sides of neck covered with scales instead of granules; more than 65 scales around middle of body; no light longitudinal dorsolateral stripes; no red in coloration; dorsal crest in males higher than in any other race.

*Types.*—Vienna Museum. Collected by Dr. Habel on "Indefatigable [?] and Bindloe Islands," Galapagos Archipelago.

*Distribution.*—This species is peculiar to Bindloe Island, Galapagos Archipelago.

*Material.*—The Academy's collection contains about one hundred and seventy-three specimens, of which forty males and seventy-five females have been included in the table of scale counts.

*Description of adult male No. 12397.*—The head is covered above with smooth scales; interparietal largest, broader than long; five or six large supraoculars; superciliaries imbricate; five superior and five inferior labials, to below middle of eye; rostral very broad and low; symphyseal broad, followed by a series of large sublabials, of which all but the first are separated from the infralabials by a row of smaller plates. Ear-opening large, with an anterior denticulation of five or six long, narrow scales. Side of neck between ear-opening and fore limb with comparatively few folds, covered with keeled, imbricate scales. A strong antehumeral, but no complete gular, fold. A well-developed median dorsal crest begins about half the length of the interparietal behind this plate, and runs continuously to and along the tail, being highest on the proximal fourth of the tail. The dorsal regions of the neck, body, and tail are covered with rather small, keeled, mucronate scales, which, on the body, change gradually to smaller, keeled, mucronate laterals. These again change gradually into the smooth ventrals, which are a little smaller than the dorsals. The gular scales are smooth, smaller posteriorly, smallest below the ears. The scales on the chest are largest, smooth and imbricate. The limbs are provided above with keeled, and below with smooth, scales. The posterior surface of the thigh is covered with rather small scales. The lateral caudals are strongly keeled and mucronate, while the inferior caudals are smooth proximally, but become keeled on the distal portion of the tail.

The general coloration in alcohol is grayish brown, with little evidence of darker markings except a black blotch in front of the shoulder. The posterior gular region is darker. The head, neck, body, limbs, and tail are very slightly specked with light bluish gray, but there is no band of the same color along the medium dorsal region. The hind limbs are not distinctly spotted with black. The lower surfaces are yellowish white more or less suffused with brown.

| | |
|---|---|
| Length to anus | mm. 111 |
| Length of tail | 140+ |
| Snout to ear | 23 |
| Width of head | 18 |
| Fore limb | 48 |
| Hind limb | 81 |
| Base of fifth to end of fourth toe | 31 |
| Height of crest on nape | 5 |
| Height of crest on midbody | 4 |
| Height of crest on tail | 5 |

*Coloration in life of adult male.*—Above dark brown, spotted with light gray; crest grayish; tail and nape olive brown; limbs above lighter, more spotted; top of head olive brown. Belly grayish; breast red with dark blotches; throat and lower jaw also dark, but with more red than the breast. Sides of body and neck lake red; a black antehumeral spot.

*Coloration in life of adult female.*—Above dusky greenish spotted with black, becoming dusky on the tail, and brown on the head; limbs above with much light olive. Sides of body dark lake red, chest lighter red; lower jaw and throat dark, like the sides. Belly and limbs below clay yellow; tail inferiorly dusky yellow. Sides of head light brown; sides of neck dark red like throat; a black antehumeral spot.

*Variation.*—Males may have the throat quite light, but it usually is dark, and this coloring extends down over the under surface of the shoulders. Females have light or dark gray throats, sometimes with a slight showing of red. The dark coloring of the back may extend down on the lower surfaces of the body and limbs, so that these surfaces may be everywhere dark gray, or may show only a little gray.

The interoccipital is as wide as long. Variation in the scale counts is shown in the following table:

TABLE OF SCALE COUNTS—BINDLOE ISLAND

| Number | Sex | Scale Rows | Crest | Belly | Number | Sex | Scale Rows | Crest | Belly |
|---|---|---|---|---|---|---|---|---|---|
| 12275 | ♂ | 75 | 49 | 75 | 12282 | ♀ | 71 | 50 | 69 |
| 12277 | ♂ | 74 | 51 | 75 | 12287 | ♀ | 68 | 47 | 71 |
| 12278 | ♂ | 71 | 54 | 78 | 12298 | ♀ | 73 | 50 | 74 |
| 12279 | ♂ | 69 | 47 | 75 | 12305 | ♀ | 70 | 53 | 72 |
| 12280 | ♂ | 75 | 51 | 76 | 12306 | ♀ | 68 | 50 | 70 |
| 12284 | ♂ | 70 | 51 | 77 | 12307 | ♀ | 68 | 46 | 72 |
| 12285 | ♂ | 70 | 46 | 74 | 12308 | ♀ | 73 | 50 | 70 |
| 12288 | ♂ | 66 | 49 | 75 | 12311 | ♀ | 73 | 47 | 74 |
| 12291 | ♂ | 68 | 47 | 71 | 12312 | ♀ | 71 | 51 | 71 |
| 12293 | ♂ | 73 | 52 | 80 | 12313 | ♀ | 70 | 45 | 73 |
| 12295 | ♂ | 72 | 51 | 76 | 12314 | ♀ | 72 | 53 | 76 |

TABLE OF SCALE COUNTS—BINDLOE ISLAND—*Continued*

| Number | Sex | Scale Rows | Crest | Belly |
|---|---|---|---|---|
| 12297 | ♂ | 66 | 49 | 75 |
| 12304 | ♂ | 66 | 48 | 76 |
| 12317 | ♂ | 70 | 52 | 76 |
| 12318 | ♂ | 70 | 50 | 73 |
| 12323 | ♂ | 70 | 51 | 76 |
| 12325 | ♂ | 70 | 49 | 74 |
| 12327 | ♂ | 70 | 49 | 76 |
| 12333 | ♂ | 70 | 52 | 75 |
| 12337 | ♂ | 67 | 46 | 73 |
| 12350 | ♂ | 70 | 50 | 73 |
| 12353 | ♂ | 71 | 48 | 72 |
| 12354 | ♂ | 71 | 47 | 74 |
| 12362 | ♂ | 72 | 50 | 75 |
| 12374 | ♂ | 72 | 49 | 77 |
| 12380 | ♂ | 75 | 50 | 78 |
| 12383 | ♂ | 69 | 49 | 80 |
| 12384 | ♂ | 69 | 47 | 78 |
| 12385 | ♂ | 74 | 46 | 70 |
| 12389 | ♂ | 69 | 51 | 71 |
| 12390 | ♂ | 72 | 47 | 70 |
| 12395 | ♂ | 75 | 48 | 78 |
| 12397 | ♂ | 72 | 46 | 74 |
| 12402 | ♂ | 71 | 53 | 74 |
| 12419 | ♂ | 70 | 47 | 71 |
| 12420 | ♂ | 70 | 51 | 77 |
| 12427 | ♂ | 71 | 52 | 73 |
| 12429 | ♂ | 68 | 53 | 80 |
| 12430 | ♂ | 69 | 46 | 76 |
| 12435 | ♂ | 71 | 51 | 74 |
| 12315 | ♀ | 70 | 47 | 76 |
| 12316 | ♀ | 75 | 55 | 77 |
| 12319 | ♀ | 71 | 49 | 73 |
| 12320 | ♀ | 72 | 49 | 73 |
| 12321 | ♀ | 72 | 46 | 75 |
| 12322 | ♀ | 68 | 48 | 75 |
| 12324 | ♀ | 68 | 46 | 72 |
| 12326 | ♀ | 74 | 48 | 71 |
| 12328 | ♀ | 70 | 51 | 70 |
| 12329 | ♀ | 69 | 50 | 72 |
| 12330 | ♀ | 70 | 50 | .. |
| 12331 | ♀ | 75 | 48 | 70 |
| 12332 | ♀ | 67 | 43 | 72 |
| 12334 | ♀ | 69 | 52 | 76 |
| 12335 | ♀ | 71 | 45 | 74 |
| 12338 | ♀ | 70 | 47 | 71 |
| 12339 | ♀ | 68 | 50 | 76 |
| 12340 | ♀ | 68 | 48 | 72 |
| 12341 | ♀ | 69 | 48 | 72 |
| 12342 | ♀ | 67 | 43 | 74 |
| 12343 | ♀ | 68 | 48 | 71 |
| 12344 | ♀ | 67 | 51 | 69 |
| 12345 | ♀ | 69 | 47 | 69 |
| 12346 | ♀ | 68 | 49 | 71 |
| 12348 | ♀ | 69 | 50 | 76 |
| 12349 | ♀ | 68 | 50 | 68 |
| 12351 | ♀ | 70 | 47 | 70 |
| 12358 | ♀ | 68 | 51 | 72 |
| 12361 | ♀ | 67 | 51 | 72 |
| 12363 | ♀ | 69 | 45 | 73 |
| 12365 | ♀ | 68 | 48 | 70 |
| 12367 | ♀ | 68 | 47 | 69 |
| 12373 | ♀ | 69 | 45 | 68 |
| 12375 | ♀ | 66 | 50 | 70 |
| 12376 | ♀ | 70 | 46 | 71 |
| 12377 | ♀ | 69 | 53 | 75 |
| 12378 | ♀ | 71 | 53 | 76 |
| 12381 | ♀ | 67 | 52 | 71 |
| 12387 | ♀ | 68 | 47 | 72 |
| 12388 | ♀ | 68 | 48 | 69 |
| 12393 | ♀ | 69 | 47 | 68 |
| 12394 | ♀ | 68 | 45 | 70 |
| 12396 | ♀ | 70 | 50 | 73 |
| 12398 | ♀ | 67 | 51 | 72 |
| 12400 | ♀ | 73 | 49 | 75 |
| 12401 | ♀ | 71 | 44 | 74 |
| 12403 | ♀ | 69 | 49 | 74 |
| 12404 | ♀ | 70 | 48 | 74 |
| 12406 | ♀ | 71 | 52 | 74 |
| 12407 | ♀ | 75 | 49 | 72 |
| 12408 | ♀ | 71 | 48 | 73 |
| 12409 | ♀ | 70 | .. | 75 |
| 12410 | ♀ | 74 | 51 | 75 |
| 12412 | ♀ | 71 | 50 | 76 |
| 12413 | ♀ | 72 | 48 | 74 |
| 12414 | ♀ | 73 | 54 | 76 |

TABLE OF SCALE COUNTS—BINDLOE ISLAND—*Continued*

| Number | Sex | Scale Rows | Crest | Belly |
|---|---|---|---|---|
| 12415 | ♀ | 75 | 50 | 75 |
| 12417 | ♀ | 69 | 50 | 75 |
| 12418 | ♀ | 71 | 49 | 73 |
| 12421 | ♀ | 72 | 50 | 77 |
| 12422 | ♀ | 71 | 46 | 77 |
| 12423 | ♀ | 68 | 49 | 71 |
| 12424 | ♀ | 74 | 48 | 77 |
| 12432 | ♀ | 71 | 48 | 71 |

*Habits.*—Bindloe Island, Sept. 17, 1906. We rowed down the coast about a mile to where the brush came down to the beach, and then worked inland toward the rim of the crater. Near the coast the ground is black ashes covered with low brush and a few small trees. Farther inland the brush becomes very thick, and cactus appears. About one mile inland we found the lizards abundant all through the brush. They keep well under cover, and rarely come into the open. The numerous hawks make them very wild. They are all dark in color, the males being about the color of the black ashes. Some have a very prominent dorsal crest. The stomachs of several examined contained vegetable matter. Insects seem to be scarce; sprouts and green leaves, though not particularly plentiful, form their principal articles of diet. The ovaries of several females were well developed. King worked along the rocks near the water, and found *Tropiduri* abundant. They seem to range over the rocks along the coast. The belt near the shore where the brush is not thick seems to be deserted. Beginning a mile inland, one finds them again, and they range thence to the top of the island.

Their "food appears to be wholly vegetable. All stomachs examined contained blossoms, seed-capsules, and berries." (Heller.)

*General remarks.*—This is one of the larger species. The males have higher crests than found in any other of the Galapagos *Tropiduri,* and show fewer black markings. The crests of the females are much lower. The sides of the neck are covered with imbricate scales, as in the case of the Chatham Island lizard.

## Tropidurus bivittatus (Peters)

Chatham Island Lizard

1843, *Leiocephalus grayii*, BELL, Zool. Beagle Rept., 1843, p. 24 (part); GRAY, Cat. Lizards, 1844, p. 218 (part); GÜNTHER, Proc. Zool. Soc. Lond., 1877, p. 67 (part).

1871, *Craniopeltis bivittata*, PETERS, Mon. Berlin. Acad., 1871, p. 645 (type locality **Chatham Island, Galapagos Archipelago).**

1876. *Tropidurus (Craniopeltis) grayii*, STEINDACHNER, Festschrift Zool.-Bot. Ges. Wien, 1876, p. 310 (part).

1885, *Tropidurus grayi*, BOULENGER, Cat. Lizards, II, 1885, p. 172.

1889, *Tropidurus lemniscatus*, COPE, Proc. U. S. Nat. Mus., XII, 1889, p. 145 (type locality **Chatham Island, Galapagos Archipelago)**; BAUR, Biol. Centralbl., X, 1890, pp. 478, 479.

1891, *Tropidurus bivittatus*, BOULENGER, Ann. and Mag. Nat. Mus., (6), VII, 1891, p. 501; BAUR, Festschrift für Leuckart, 1902, p. 272; HELLER, Proc. Washington Acad. Sci., V. 1903, p. 80.

*Diagnosis.*—Neck with fewer folds, sides of neck covered with scales instead of granules; not more than 65 scales around middle of body; males longitudinally striped; no red in coloration; crest of males not very high.

*Types.*—The material upon which Peters based his description of *Craniopeltis bivittata* was secured on **Chatham Island** by Dr. Kingberg, in 1852, and probably is in the Museum of Stockholm. Cope's *Tropidurus lemniscatus* was described from specimens collected by the naturalists of the "Albatross," in 1887-88, upon **Chatham Island.** These specimens are now Nos. 14945 to 14964 of the U. S. National Museum collection.

*Distribution.*—This species is restricted to Chatham Island, Galapagos Archipelago.

*Material.*—The Academy's collection contains about two hundred and eighty specimens of this species, of which seventy-three males and forty-two females have been included in the table of scale counts.

*Description of adult male No. 9920.*—The head is covered above with smooth scales; interparietal largest, broader than long; five or six large supraoculars; superciliaries imbricate; four superior and five inferior labials, to below the middle of the eye; rostral very broad and low; symphyseal broad, followed by a series of large sublabials, of which all but the first are separated from the infralabials by a row of smaller plates. Ear-opening large, with an anterior denticulation of five or six narrow scales. Side of neck between ear-opening and fore limb with few folds, covered with keeled, imbricate scales. Strong antehumeral, but no complete gular, fold. A well-developed median dorsal crest begins a short distance behind the interparietal, and runs continuously to and along the tail, being highest on the proximal fourth of the tail. The dorsal regions of the neck, body, and tail are covered with keeled, mucronate scales, which, on the body, change gradually to smaller, keeled, mucronate laterals. These again change gradually into the smooth ventrals, which are much smaller than the dorsals. The gular scales are smooth,

smaller posteriorly, smallest centrally. The scales on the chest are about as large as the dorsals, smooth and imbricate. The limbs are provided above with keeled scales, and below, except on the forearms, hands, and feet, with smooth scales. The posterior surface of the thigh is covered with smooth imbricate scales. The lateral caudals are strongly keeled and mucronate; while the inferior caudals are smooth proximally, but become keeled on the distal portion of the tail.

The general coloration in alcohol is brown, with a very distinct greenish-yellow dorsolateral light stripe, and a somewhat less distinct lateral stripe, along each side of the body. There are slight indications of darker brown cross-bars. The head, limbs, and tail are brown, unicolor or with a few small light spots. The lower surfaces are white clouded with brown on the chin, throat, and limbs. There is a black antehumeral blotch. Females lack the light longitudinal streaks.

| | |
|---|---|
| Length to anus ..... mm. | 79 |
| Length of tail ..... | 127+ |
| Snout to ear ..... | 17 |
| Width of head ..... | 14 |
| Fore limb ..... | 36 |
| Hind limb ..... | 60 |
| Base of fifth to end of fourth toe ..... | 22 |
| Height of crest on nape ..... | 1.5 |
| Height of crest on midbody ..... | 1 |
| Height of crest on tail ..... | 1.8 |

*Coloration in life of adult male.*—Above olive brown, top of head darker brown; a light stripe two and one-half scales wide beginning behind the eye, running slightly upward above the ear and along the sides to the base of the tail; a narrow stripe of the same color beginning at the axilla and extending along sides to base of thigh. Belly yellowish, red-tinged; breast, tail, and hind limbs below soiled whitish or grayish; throat and lower jaw the same; sides of head grayish; sides of body below the lateral stripes barred yellow and brick red; a black antehumeral spot. Limbs above spotted with brown and gray; tail posteriorly light brown.

*Coloration in life of adult female.*—Above golden brown, darker on top of head and along base of dorsal crest; limbs above like the back. Sides of head brownish; sides of throat and body bright brick red; a slaty antehumeral spot with black center. Belly and inferior surfaces of limbs cream; tail yellowish below. Chin greenish; rest of lower jaw, throat, and breast buffy. Eyelids dark blue-green.

*Variation.*—The females agree in the faintness or absence of the light dorsolateral band, which is so characteristic of the males of this species. They also lack the black blotch in front of the arm, which the males constantly show except when young. The dark cross-lines on the sublabial region may be indistinct or absent.

The interoccipital plate is wider than long. The crests are higher in males than in females, and increase in height with age. The scale counts are given in the following table:

TABLE OF SCALE COUNTS—CHATHAM ISLAND

| Number | Sex | Scale Rows | Crest | Belly | Number | Sex | Scale Rows | Crest | Belly |
|---|---|---|---|---|---|---|---|---|---|
| 9916 | ♂ | 59 | 44 | 70 | 9866 | ♀ | 55 | 46 | 75 |
| 9919 | ♂ | 58 | 44 | 71 | 9867 | ♀ | 60 | 49 | 71 |
| 9920 | ♂ | 63 | 46 | 73 | 9868 | ♀ | 62 | 46 | 74 |
| 9922 | ♂ | 54 | 47 | 64 | 9869 | ♀ | 56 | 47 | 76 |
| 9923 | ♂ | 61 | 50 | 75 | 9870 | ♀ | 58 | 50 | 71 |
| 9924 | ♂ | 60 | 46 | 72 | 9871 | ♀ | 53 | 44 | 72 |
| 9925 | ♂ | 57 | 47 | 70 | 9872 | ♀ | 58 | 50 | 71 |
| 9926 | ♂ | 58 | 45 | 75 | 9882 | ♀ | 58 | 46 | 73 |
| 9927 | ♂ | 63 | 42 | 71 | 9900 | ♀ | 56 | 47 | 73 |
| 9928 | ♂ | 57 | 52 | 72 | 9901 | ♀ | 54 | .. | 73 |
| 9929 | ♂ | 64 | 44 | 77 | 9902 | ♀ | 53 | .. | 67 |
| 9930 | ♂ | 62 | 47 | 70 | 9903 | ♀ | 58 | 45 | 74 |
| 9931 | ♂ | 60 | 44 | 70 | 9904 | ♀ | 57 | 51 | 73 |
| 9932 | ♂ | 56 | 47 | 72 | 9905 | ♀ | 55 | 49 | 70 |
| 9934 | ♂ | 57 | 45 | 71 | 9917 | ♀ | 59 | 44 | 67 |
| 9935 | ♂ | 59 | 45 | 72 | 9918 | ♀ | 56 | 48 | 73 |
| 9936 | ♂ | 59 | 45 | 71 | 9921 | ♀ | 57 | 51 | 75 |
| 9938 | ♂ | 60 | 43 | 72 | 9943 | ♀ | 62 | 50 | 73 |
| 9939 | ♂ | 58 | 45 | 71 | 9944 | ♀ | 53 | 44 | 70 |
| 9940 | ♂ | 58 | 45 | 71 | 9946 | ♀ | 58 | 50 | 70 |
| 9941 | ♂ | 58 | 45 | 67 | 9956 | ♀ | 61 | 45 | 66 |
| 9942 | ♂ | 59 | 46 | 68 | 9969 | ♀ | 56 | 48 | 73 |
| 9949 | ♂ | 54 | 42 | 67 | 9971 | ♀ | 57 | 45 | 69 |
| 9951 | ♂ | 58 | 43 | 70 | 10005 | ♀ | 55 | 47 | 70 |
| 9952 | ♂ | 59 | 45 | 67 | 10006 | ♀ | 58 | 50 | 72 |
| 9953 | ♂ | 62 | 41 | 73 | 11022 | ♀ | 61 | 49 | 75 |
| 9954 | ♂ | 59 | 42 | 67 | 11023 | ♀ | 58 | 50 | 75 |
| 9955 | ♂ | 58 | 42 | 73 | 11024 | ♀ | 61 | 49 | 68 |
| 9958 | ♂ | 57 | 50 | 72 | 11028 | ♀ | 60 | 51 | 69 |
| 9959 | ♂ | 58 | 47 | 71 | 11032 | ♀ | 60 | 50 | 72 |
| 11025 | ♂ | 55 | 48 | 71 | 11037 | ♀ | 60 | 52 | 75 |
| 11026 | ♂ | 56 | 46 | 71 | 11038 | ♀ | 60 | 47 | 73 |
| 11027 | ♂ | 56 | 47 | 70 | 11041 | ♀ | 55 | 49 | 67 |
| 11029 | ♂ | 57 | 47 | 74 | 11047 | ♀ | 58 | 50 | 74 |
| 11030 | ♂ | 58 | 46 | 74 | 11050 | ♀ | 57 | 47 | 71 |
| 11031 | ♂ | 58 | 44 | 70 | 11971 | ♀ | 59 | 46 | 75 |
| 11033 | ♂ | 61 | 45 | 68 | 11972 | ♀ | 57 | 47 | 73 |
| 11034 | ♂ | 62 | 44 | 77 | 11978 | ♀ | 61 | 45 | 74 |
| 11035 | ♂ | 56 | 47 | 62 | 11979 | ♀ | 57 | 47 | 72 |
| 11036 | ♂ | 58 | 48 | 69 | 11980 | ♀ | 56 | 42 | 69 |
| 11042 | ♂ | 59 | 48 | 67 | 11985 | ♀ | 61 | 42 | 73 |
| 11043 | ♂ | 56 | 50 | 72 | 11988 | ♀ | 59 | 50 | 75 |
| 11044 | ♂ | 57 | 43 | 68 | | | | | |
| 11045 | ♂ | 57 | 45 | 72 | | | | | |
| 11046 | ♂ | 53 | 42 | 67 | | | | | |
| 11048 | ♂ | 55 | 48 | 62 | | | | | |
| 11049 | ♂ | 58 | 48 | 70 | | | | | |
| 11955 | ♂ | 64 | 49 | 72 | | | | | |
| 11956 | ♂ | 58 | 39 | 70 | | | | | |
| 11958 | ♂ | 59 | 45 | 71 | | | | | |

TABLE OF SCALE COUNTS—CHATHAM ISLAND—*Continued*

| Number | Sex | Scale Rows | Crest | Belly |
|---|---|---|---|---|
| 11959 | ♂ | 63 | 45 | 69 |
| 11960 | ♂ | 62 | 45 | 68 |
| 11961 | ♂ | 62 | 42 | 69 |
| 11962 | ♂ | 63 | 47 | 74 |
| 11964 | ♂ | 59 | 46 | 74 |
| 11965 | ♂ | 63 | 48 | 75 |
| 11966 | ♂ | 56 | 41 | 62 |
| 11967 | ♂ | 57 | 47 | 66 |
| 11968 | ♂ | 60 | 40 | 67 |
| 11969 | ♂ | 61 | 44 | 73 |
| 11970 | ♂ | 64 | 45 | 71 |
| 11973 | ♂ | 63 | 42 | 72 |
| 11974 | ♂ | 57 | 42 | 68 |
| 11975 | ♂ | 58 | 43 | 71 |
| 11976 | ♂ | 59 | 50 | 73 |
| 11977 | ♂ | 53 | 45 | 67 |
| 11981 | ♂ | 59 | 45 | 75 |
| 11982 | ♂ | 63 | 44 | 73 |
| 11983 | ♂ | 61 | 47 | 73 |
| 11984 | ♂ | 60 | 45 | 74 |
| 11986 | ♂ | 59 | 44 | 72 |
| 11987 | ♂ | 61 | 43 | 70 |
| 11989 | ♂ | 56 | 47 | 75 |

*Habits.*—Chatham Island, Oct. 16, 1905. I went ashore at Wreck Bay, and worked near the coast. *Tropiduri* were fairly common. I found one (No. 1355) with a piece of crab's leg in its mouth, and another (No. 1380) with a large worm. A great many were small, and I saw no very large ones. Jan. 15, 1906. Saw several *Tropiduri* shedding their skins. The females contain eggs now in January. Jan. 29. Went to the top of Chatham Island. The soil is damp, and no reptiles were observed. Beyond a mile from the shore no *Tropiduri* are to be seen. Feb. 8. Went ashore at Fresh Water Bay, and worked up to about 1000 feet. I saw only six lizards, all very wild, probably owing to the presence of numerous cats, of which we saw many signs. I suppose the highest altitude at which the lizards were observed was 600 feet. Feb. 10. Went ashore at Sappho Cove and worked inland. Lizards are very scarce. Feb. 23. Went collecting at Wreck Bay, and got only a few *Tropiduri* and geckos. The lizards seem to be fewer in number at this season. One female was obtained with large eggs. July 5. Went up to the road at Wreck Bay collecting. Find the lizards rare now, and most of them are very small. The island is very dry now, it being the winter

season, and the natives report having had no rain for some time.

*General remarks.*—The Chatham Island *Tropidurus* is one of the smaller species. The males are very prettily striped, while the females are nearly unicolor. The crest is moderately well developed in the males, low in the females. This species agrees with the Bindloe lizard in having scales instead of granules on the sides of the neck, a character which distinguishes these two species from all the other species of the archipelago.

### **Tropidurus delanonis** Baur

Hood Island Lizard

1889, *Tropidurus grayi,* Cope, Proc. U. S. Nat. Mus., XII, 1889, p. 145 (part); Boulenger, Ann. and Mag. Nat. Hist., (6), VII, 1891, p. 502 (part).

1890, *Tropidurus delanonis,* Baur, Biol. Centralbl., X, 1890, pp. 478, 479 (type locality **Hood Island, Galapagos Archipelago**); Baur, Festschrift für Leuckart, 1892, p. 270; Heller, Proc. Washington Acad. Sci., V, 1903, p. 78.

1890, *Tropidurus hoodensis,* Baur, reprints from Biol. Centralbl., X, 1890, pp. 478, 479 (substituting name); Baur, Festschrift für Leuckart, 1892, pp. 265, 270.

*Diagnosis.*—Sides of neck with numerous folds; skin between folds covered with granules, some small scales on ridges of folds of large males; hind legs of males with definite dark spots; interparietal plate seldom much broader than long; not more than eighty scales around middle of body; 50 to 61 scales in crest; back not definitely spotted as in *T. grayi;* much red in coloration; old males larger than in other species.

*Types.*—This species was described by Dr. Baur from thirteen specimens, numbered 15014 to 15026 of the U. S. National Museum collection, which had been secured on **Hood Island** by the naturalists of the "Albatross," in April, 1888.

*Distribution.*—This species has been found only on Hood Island and Gardner-near-Hood, Galapagos Archipelago.

*Material.*—The Academy's collection contains about two hundred and forty specimens from Hood, and twenty-three from Gardner; of which seventy males and sixty-eight females from Hood, and seven males and six females from Gardner have been included in the tables of scale counts.

*Description of adult male No. 11802.*—The head is covered above with smooth scales; interparietal largest, little if any broader than long; five to seven large supraoculars; superciliaries imbricate; five superior and

five inferior labials, to below middle of the eye; rostral very broad and low; symphyseal broad, followed by a series of large sublabials, of which all but the first are separated from the infralabials by a row of smaller plates. Ear-opening large, with an anterior denticulation of five or six long, narrow scales. Side of neck between ear-opening and fore limb with numerous folds, mostly covered with granular scales. A strong antehumeral, but no complete gular, fold. A well-developed median dorsal crest begins a short distance behind the interparietal plate, and runs continuously to and along the tail, being highest on the proximal fourth of the tail. The dorsal regions of the neck, body, and tail are covered with keeled, mucronate scales, which, on the body, change gradually to smaller, keeled, mucronate laterals. These again change gradually into the smooth ventrals, which are considerably smaller than the dorsals. The gular scales are smooth, smaller posteriorly, smallest below the ears. The scales on the chest are largest, smooth, and imbricate. The limbs are provided above with keeled, and below with smooth, scales. The posterior surface of the thigh is covered with smooth sub-granular scales, between which smaller granules may often be seen. The lateral caudals are strongly keeled and mucronate; while the inferior caudals are smooth proximally, but become keeled on the distal portion of the tail.

The coloration in alcohol is olive brown above, spotted, except on the head and tail, with small, rounded, discrete blackish spots, each covering one or more scales. The chin is grayish slate. The gular region and chest are black. The other lower surfaces are grayish yellow.

| | |
|---|---|
| Length to anus ..... mm. | 137 |
| Length of tail ..... | 163+ |
| Snout to ear ..... | 16 |
| Width of head ..... | 21 |
| Fore limb ..... | 54 |
| Hind limb ..... | 85 |
| Base of fifth to end of fourth toe ..... | 30 |
| Height of crest on nape ..... | 1.5 |
| Height of crest on midbody ..... | 1 |
| Height of crest on tail ..... | 3 |

*Coloration in life of adult male.*—Above olive brown, spotted, except the head, with light yellowish; tail dark reddish, the crest light brown; hind limbs reddish, light-spotted distally; fore limbs like the sides of the body. Belly medially, and hind limbs and tail inferiorly, dusky-yellow; the belly anteriorly and laterally red. Mandible dark greenish gray, throat black, chest black with large straw-yellow blotches. Fore limbs below proximally like the breast. Sides of head and neck light brown with black blotches; sides of body reddish, spotted with light yellow; tail brick red on the sides.

*Coloration in life of adult female.*—Body and tail above olive brown; limbs similar in coloration. Sides of belly and tail reddish; a black antehumeral spot. Whole head, throat, and chest brick red, becoming darker on nape and top of head, fading to dull orange on anterior belly; belly and tail and hind limbs inferiorly cream yellow; fore limbs below proximally like the breast.

*Variation.*—The two sexes from this island differ more than in other species; but there is little variation among the females, and still less among the males. The females all agree in having the black blotch in front of the shoulder and brick red coloring of the throat, which in some specimens extends down to the under surface of the shoulders. The males show little or no variation. Some specimens show red on the sides and the under surface of the tail. They all agree in the black throat and scattered black markings extending down past the shoulders. Specimens from Gardiner-near-Hood are like those from Hood. A few females taken there show a darker red, but this is not constant.

The interoccipital usually is as long as wide, but in a few specimens is wider than long. Scale counts are shown in the following table:

TABLE OF SCALE COUNTS—HOOD ISLAND

| Number | Sex | Scale Rows | Crest | Belly | Number | Sex | Scale Rows | Crest | Belly |
|---|---|---|---|---|---|---|---|---|---|
| 9252 | ♂ | 67 | 54 | 77 | 9250 | ♀ | 76 | 60 | 85 |
| 9254 | ♂ | 71 | 51 | 81 | 9322 | ♀ | 68 | 51 | 78 |
| 9256 | ♂ | 69 | 53 | 77 | 9330 | ♀ | 70 | 53 | 74 |
| 9257 | ♂ | 70 | 56 | 82 | 10888 | ♀ | 71 | 54 | 73 |
| 9258 | ♂ | 69 | 51 | 77 | 10889 | ♀ | 73 | 57 | 79 |
| 9259 | ♂ | 69 | 55 | 77 | 10890 | ♀ | 71 | 56 | 81 |
| 9260 | ♂ | 68 | 55 | 80 | 10892 | ♀ | 73 | 54 | 77 |
| 9261 | ♂ | 67 | 60 | 84 | 10894 | ♀ | 71 | 57 | 79 |
| 9262 | ♂ | 70 | 59 | 81 | 10895 | ♀ | 72 | 54 | 78 |
| 9264 | ♂ | 70 | 52 | 79 | 10896 | ♀ | 69 | 56 | 73 |
| 9265 | ♂ | 69 | 60 | 83 | 10900 | ♀ | 69 | 53 | 76 |
| 9266 | ♂ | 72 | 56 | 77 | 10903 | ♀ | 70 | 56 | 83 |
| 9267 | ♂ | 69 | 56 | 78 | 10904 | ♀ | 69 | 54 | 73 |
| 9268 | ♂ | 69 | 51 | 81 | 10905 | ♀ | 69 | 53 | 78 |
| 9310 | ♂ | 69 | 55 | 85 | 10906 | ♀ | 70 | 55 | 83 |
| 9311 | ♂ | 67 | 52 | 78 | 10908 | ♀ | 73 | 59 | 71 |
| 9312 | ♂ | 69 | 55 | 74 | 10909 | ♀ | 76 | 57 | 79 |
| 9317 | ♂ | 67 | 51 | 80 | 10910 | ♀ | 70 | 53 | 79 |
| 9318 | ♂ | 74 | 60 | 79 | 10913 | ♀ | 77 | 58 | 75 |
| 9319 | ♂ | 73 | 58 | 77 | 10914 | ♀ | 70 | 56 | 79 |
| 9324 | ♂ | 68 | 55 | 80 | 10915 | ♀ | 70 | 54 | 75 |
| 9325 | ♂ | 67 | 52 | 84 | 11829 | ♀ | 70 | 61 | 74 |
| 9326 | ♂ | 71 | 51 | 81 | 11830 | ♀ | 66 | 55 | 76 |
| 9327 | ♂ | 67 | 53 | 79 | 11831 | ♀ | 70 | 54 | 78 |
| 10886 | ♂ | 64 | 56 | 82 | 11832 | ♀ | 71 | 53 | 79 |
| 10887 | ♂ | 76 | 51 | 83 | 11833 | ♀ | 73 | 56 | 84 |
| 10891 | ♂ | 68 | 57 | 81 | 11834 | ♀ | 68 | 57 | 74 |
| 10893 | ♂ | 69 | 52 | 78 | 11835 | ♀ | 74 | 55 | 77 |
| 10897 | ♂ | 74 | 51 | 83 | 11836 | ♀ | 76 | 55 | 80 |
| 10898 | ♂ | 69 | 57 | 82 | 11837 | ♀ | 76 | 57 | 74 |
| 10899 | ♂ | 72 | 53 | 78 | 11838 | ♀ | 75 | 57 | 78 |
| 10901 | ♂ | 68 | 58 | 81 | 11839 | ♀ | 69 | 56 | 78 |

TABLE OF SCALE COUNTS—HOOD ISLAND—*Continued*

| Number | Sex | Scale Rows | Crest | Belly | Number | Sex | Scale Rows | Crest | Belly |
|---|---|---|---|---|---|---|---|---|---|
| 10902 | ♂ | 72 | 57 | 86 | 11843 | ♀ | 70 | 58 | 83 |
| 10907 | ♂ | 71 | 52 | 79 | 11844 | ♀ | 72 | 57 | 76 |
| 10911 | ♂ | 70 | 54 | 81 | 11845 | ♀ | 73 | 56 | 79 |
| 10912 | ♂ | 68 | 58 | 83 | 11846 | ♀ | 66 | 57 | 75 |
| 10916 | ♂ | 70 | .. | 78 | 11847 | ♀ | 71 | 58 | 86 |
| 10917 | ♂ | 69 | 57 | 76 | 11848 | ♀ | 69 | 61 | 77 |
| 10918 | ♂ | 71 | 56 | 81 | 11850 | ♀ | 78 | 59 | 86 |
| 11798 | ♂ | 69 | 55 | 73 | 11852 | ♀ | 69 | 61 | 81 |
| 11801 | ♂ | 67 | 51 | 77 | 11854 | ♀ | 76 | 61 | 83 |
| 11802 | ♂ | 68 | 52 | 75 | 11855 | ♀ | 66 | 52 | 76 |
| 11804 | ♂ | 71 | 55 | 75 | 11859 | ♀ | 72 | 58 | 82 |
| 11805 | ♂ | 72 | 52 | 67 | 11860 | ♀ | 69 | 59 | 80 |
| 11806 | ♂ | 70 | 54 | 75 | 11861 | ♀ | 77 | 57 | 83 |
| 11807 | ♂ | 76 | 61 | 81 | 11862 | ♀ | 68 | 51 | 74 |
| 11808 | ♂ | 72 | 53 | 78 | 11863 | ♀ | 68 | 55 | 80 |
| 11810 | ♂ | 76 | 50 | 80 | 11864 | ♀ | 69 | 57 | 74 |
| 11811 | ♂ | 71 | 57 | 75 | 11865 | ♀ | 76 | 54 | 82 |
| 11812 | ♂ | 70 | 54 | 73 | 11866 | ♀ | 72 | 57 | 78 |
| 11813 | ♂ | 70 | 50 | 70 | 11867 | ♀ | 72 | 58 | 76 |
| 11816 | ♂ | 68 | 51 | 76 | 11868 | ♀ | 70 | 57 | 84 |
| 11817 | ♂ | 69 | 52 | 75 | 11869 | ♀ | 73 | 54 | 80 |
| 11820 | ♂ | 67 | 54 | 73 | 11870 | ♀ | 68 | 55 | 83 |
| 11821 | ♂ | 68 | 51 | 76 | 11872 | ♀ | 71 | 58 | 78 |
| 11824 | ♂ | 74 | 56 | 76 | 11873 | ♀ | 72 | 57 | 75 |
| 11825 | ♂ | 67 | 53 | 73 | 11874 | ♀ | 72 | 53 | 71 |
| 11826 | ♂ | 69 | 55 | 80 | 11878 | ♀ | 76 | 56 | 74 |
| 11827 | ♂ | 71 | 52 | 79 | 11881 | ♀ | 75 | 54 | 74 |
| 11828 | ♂ | 70 | 57 | 76 | 11882 | ♀ | 75 | 54 | 83 |
| 11900 | ♂ | 74 | 58 | 80 | 11883 | ♀ | 72 | 54 | 82 |
| 11902 | ♂ | 72 | 56 | 79 | 11884 | ♀ | 71 | 56 | 74 |
| 11904 | ♂ | 73 | 50 | 76 | 11885 | ♀ | 78 | 61 | 83 |
| 11905 | ♂ | 71 | 52 | 72 | 11888 | ♀ | 70 | 56 | 77 |
| 11906 | ♂ | 70 | 51 | 77 | 11889 | ♀ | 73 | 55 | 79 |
| 11907 | ♂ | 70 | 53 | 80 | 11890 | ♀ | 70 | 57 | 82 |
| 11908 | ♂ | 68 | 55 | 77 | 11891 | ♀ | 78 | 57 | 80 |
| 11909 | ♂ | 73 | 52 | 80 | 11894 | ♀ | 77 | 57 | 75 |
| 11910 | ♂ | 70 | 51 | 75 | | | | | |
| 11928 | ♂ | 69 | 54 | 77 | | | | | |

TABLE OF SCALE COUNTS—GARDNER-NEAR-HOOD

| Number | Sex | Scale Rows | Crest | Belly | Number | Sex | Scale Rows | Crest | Belly |
|---|---|---|---|---|---|---|---|---|---|
| 9347 | ♂ | 73 | 55 | 82 | 9353 | ♀ | 76 | 55 | .. |
| 9348 | ♂ | 70 | 56 | 79 | 9354 | ♀ | 76 | 62 | 81 |
| 9350 | ♂ | 72 | 55 | 84 | 9356 | ♀ | 68 | 52 | 83 |
| 9351 | ♂ | 74 | 56 | 83 | 9359 | ♀ | 71 | 60 | 83 |
| 9355 | ♂ | 71 | .. | 80 | 9360 | ♀ | 73 | 52 | 78 |
| 9358 | ♂ | 73 | .. | 82 | 9363 | ♀ | 71 | 52 | 83 |
| 9361 | ♂ | 73 | 52 | 81 | | | | | |

*Habits.*—Hood Island, Sept. 25, 1905. I found the lizards very common. They can be obtained easily with a stick. They

occurred all through the brush, and sometimes climbed up into the cactus trees. Although they were scattered everywhere, I found them more numerous near the beach, in the sand and brush, than on rocky soil. As a rule, they would stand perfectly still and gaze at one, but I noticed a few of the large males bobbing their heads up and down. Sept. 26. I took the eggs from a female *Tropidurus* and preserved them. They were five in number. These lizards were abundant and extremely tame. I saw some eating green leaves on the shrubs, and some would pick up crumbs from our lunch. Feb. 2, 1906. Found the *Tropidurus* common near the coast, but none to speak of near the top of the island. The vegetation is well dried up now, there being only one or two plants in leaf. I examined the stomachs of six males and one female *Tropidurus,* and found that all contained the leaves of a juicy green shrub that grows along the shore and is common on all the islands. June 25, 1906. Went down to the albatross colony and gathered in a few sea-iguanas and lizards. I find *Tropiduri* abundant everywhere, and occasionally see them on top of the cactus trees, where they go probably in search of insects. They have few enemies; hawks are not very plentiful, and the only birds that seem to harm them much are the mocking birds (Nesomimus). These can be seen picking at the lizards' tails, breaking them off in the middle, and flying away with the ends.

Gardner-near-Hood, Sept. 27, 1905. Found the *Tropiduri* fairly common, but a little more shy than on Hood Island. As a rule, the females seemed to be a little smaller than those on Hood, and a little darker under the throat, where the color is almost chocolate. Feb. 23, 1906. Saw a *Tropidurus* feeding on maggots on a dead seal, and others eating flies; but they appear to eat leaves more than anything else.

Heller states that the food of the Hood Island *Tropidurus* consists of grasshoppers, beetles, caterpillars, seed-capsules and berries.

*General remarks.*—The Hood Island *Tropidurus* attains a greater size than is reached by any other species of the archipelago. It seems to be most nearly related to the Charles

Island species, but is quite distinct. It is still fairly common. No difference has been noted between specimens from Hood Island and those from Gardner-near-Hood. Five eggs taken from a female on Hood Island, Sept. 26, 1905, measure 12×20, 13×21, 13×22, 12×23, and 12×24 mm. They have tough white, non-calcareous shells.

### **Tropidurus grayii** (Bell)

Charles Island Lizard

1843, *Leiocephalus grayii*, Bell, Zoology Beagle, Rept., 1843, p. 24, pl. XIII, fig. 1 (part) (type locality **Chatham** and **Charles Islands, Galapagos Archipelago**); Gray, Cat. Lizards, 1845, p. 218 (part); Günther, Proc. Zool. Soc. Lond., 1877, p. 67 (part).

? 1851, *Holotropis grayii*, Duméril, Cat. Méth. Rept., 1851, p. 70 (part); Duméril, Arch. Mus., VIII, p. 538 (part).

1871, *Craniopeltis grayii*, Peters, Mon. Berl. Acad., 1871, p. 645 (part).

1876, *Tropidurus* (*Craniopeltis*) *grayii*, Steindachner, Festschr. Zool.-Bot. Ges. Wien, 1876, p. 310, pl. II, fig. 1 (part).

1885, *Tropidurus grayii*, Boulenger, Cat. Lizards, II, 1885, p. 172 (part); Cope, Proc. U. S. Nat. Mus., XII, 1889, p. 145 (part); Baur, Biol. Centralbl., X, 1890, pp. 478, 479; Boulenger, Ann. & Mag. Nat. Hist., (6), VII, 1891, p. 502 (part); Baur, Festschrift für Leuckart, 1892, p. 265.

1903, *Tropidurus grayi grayi*, Heller, Proc. Washington Acad. Sci., V, 1903, p. 69 (part).

*Diagnosis.*—Sides of neck granular with numerous folds, hind legs of males with definite dark spots; interparietal plate seldom much broader than long; not more than eighty scales around middle of body; 36 to 48 scales in crest; back with very definite discrete rounded blackish spots; little or no red in coloration.

*Types.*—The original specimens were collected by Charles Darwin in 1835 during the voyage of the "Beagle," and are now in the British Museum. They were said to have been collected in **Chatham** and **Charles islands,** but the description is of the Charles Island species.

*Distribution.*—This species appears to be restricted to Charles Island and its neighboring islets, Gardner, Champion, and Enderby.

*Material.*—Besides the types collected by Darwin, this species has been secured only by Kinberg and Dr. Baur. It appears to be nearly extinct on Charles Island, where Baur collected his specimen. The Academy's collection contains fif-

teen from Charles Island, twenty-seven from Gardner-near-Charles, sixteen from Champion, and thirty-one from Enderby. Of these, one male and fourteen females from Charles, thirteen males and fourteen females from Gardner, seven males and nine females from Champion, and thirteen males and eighteen females from Enderby are included in the tables of scale counts.

*Description of adult male No. 9536.*—The head is covered above with smooth scales; interparietal largest, broader than long; four or five large supraoculars; superciliaries imbricate; five superior and five inferior labials, to below middle of the eye; rostral very broad and low; symphyseal broad, followed by a series of large sublabials, of which all but the first are separated from the infralabials by a row of smaller plates. Ear-opening large, with an anterior denticulation of five or six long, narrow scales. Side of neck between ear-opening and fore limb with numerous folds, covered with granular scales. A strong antehumeral, but no complete gular, fold. A well-developed median dorsal crest begins half the length of the interparietal behind this plate, and runs continuously to and along the tail, being highest on the proximal fourth of the tail. The dorsal regions of the neck, body, and tail are covered with rather small, keeled, mucronate scales, which, on the body, change gradually to smaller, keeled, mucronate laterals. These again change gradually into the smooth ventrals, which are a little smaller than the dorsals. The gular scales are smooth, smaller posteriorly, smallest below the ears. The scales on the chest are largest, smooth and imbricate. The limbs are provided above with keeled, and below with smooth, scales. The posterior surface of the thigh is covered with keeled, imbricate scales. The lateral caudals are strongly keeled and mucronate; while the inferior caudals are smooth proximally, but become keeled on the distal portion of the tail.

The color above is olive brown, unicolor on the top and sides of the head, but relieved with dark brown or black spots or cross-bars on the body, limbs, and base of tail. The lower surfaces are greenish white. The gular region is suffused with dark gray, and the throat and chest bear discrete, rounded spots of blackish brown.

| | |
|---|---|
| Length to anus ..... mm. | 65 |
| Length of tail ..... | 120 |
| Snout to ear ..... | 15 |
| Width of head ..... | 13 |
| Fore limb ..... | 34 |
| Hind limb ..... | 54 |
| Base of fifth to end of fourth toe ..... | 21 |
| Height of crest on nape ..... | 1 |
| Height of crest on midbody ..... | .8 |
| Height of crest on tail ..... | 1.2 |

*Variation.*—The lizards of Charles, Champion, Enderby, and Gardner-near-Charles islands seem to differ in no respect. The sexes agree in coloration, except that the males have darker throats and larger dorsal spots. Females may have either white or grayish throats, spotted with black. The inter-

occipital plate seldom is much wider than long. Variation in scale counts is shown in the following tables:

TABLE OF SCALE COUNTS—CHARLES ISLAND

| Number | Sex | Scale Rows | Crest | Belly | Number | Sex | Scale Rows | Crest | Belly |
|---|---|---|---|---|---|---|---|---|---|
| 9536 | ♂ | 62 | 44 | 73 | 9533 | ♀ | .. | .. | 66 |
| | | | | | 9534 | ♀ | 64 | 40 | 69 |
| | | | | | 9535 | ♀ | 60 | 43 | 67 |
| | | | | | 9537 | ♀ | 61 | 41 | 67 |
| | | | | | 9538 | ♀ | 60 | 42 | 67 |
| | | | | | 9539 | ♀ | 64 | .. | .. |
| | | | | | 9540 | ♀ | .. | 42 | 69 |
| | | | | | 9541 | ♀ | 62 | 43 | 65 |
| | | | | | 9542 | ♀ | 60 | .. | 70 |
| | | | | | 9543 | ♀ | 60 | 40 | 67 |
| | | | | | 11057 | ♀ | 58 | 42 | 70 |
| | | | | | 11058 | ♀ | 59 | .. | 69 |
| | | | | | 11059 | ♀ | 62 | 43 | 69 |
| | | | | | 11060 | ♀ | 60 | 44 | 74 |

TABLE OF SCALE COUNTS—GARDNER-NEAR-CHARLES

| Number | Sex | Scale Rows | Crest | Belly | Number | Sex | Scale Rows | Crest | Belly |
|---|---|---|---|---|---|---|---|---|---|
| 9422 | ♂ | 67 | 38 | 68 | 9421 | ♀ | 67 | 38 | 67 |
| 9423 | ♂ | 69 | 38 | 68 | 9424 | ♀ | 67 | 45 | 72 |
| 9425 | ♂ | 72 | 38 | 71 | 9426 | ♀ | 70 | 43 | 72 |
| 9427 | ♂ | 70 | 44 | 72 | 9429 | ♀ | 67 | 42 | 68 |
| 9428 | ♂ | 66 | 38 | 72 | 9431 | ♀ | 69 | 45 | 66 |
| 9430 | ♂ | 69 | 42 | 70 | 9432 | ♀ | 67 | 39 | 70 |
| 9433 | ♂ | 69 | 42 | 71 | 9437 | ♀ | 63 | 42 | 72 |
| 9434 | ♂ | 67 | 43 | 70 | 9439 | ♀ | 69 | 43 | 73 |
| 9435 | ♂ | 72 | 44 | 71 | 9440 | ♀ | 69 | 41 | 70 |
| 9436 | ♂ | 69 | 41 | 72 | 9441 | ♀ | 70 | 44 | 73 |
| 9438 | ♂ | 66 | 41 | 70 | 9442 | ♀ | 69 | .. | 66 |
| 9444 | ♂ | 70 | 43 | 72 | 9443 | ♀ | 70 | 43 | 66 |
| 9445 | ♂ | 69 | 40 | 70 | 9446 | ♀ | 69 | 45 | 73 |
| | | | | | 9447 | ♀ | .. | 45 | 70 |

TABLE OF SCALE COUNTS—CHAMPION ISLAND

| Number | Sex | Scale Rows | Crest | Belly | Number | Sex | Scale Rows | Crest | Belly |
|---|---|---|---|---|---|---|---|---|---|
| 9449 | ♂ | 67 | 45 | 72 | 9452 | ♀ | 64 | 48 | 76 |
| 9450 | ♂ | 66 | 43 | 73 | 9455 | ♀ | 62 | 46 | 74 |
| 9451 | ♂ | 68 | 40 | 73 | 9456 | ♀ | 64 | 45 | 72 |
| 9453 | ♂ | 61 | .. | 70 | 9457 | ♀ | 62 | 43 | 69 |
| 9454 | ♂ | 65 | 42 | 71 | 9458 | ♀ | 62 | .. | 68 |
| 9461 | ♂ | 63 | 43 | 69 | 9459 | ♀ | 62 | 41 | 72 |
| 11054 | ♂ | 62 | 42 | 76 | 9460 | ♀ | 64 | 41 | 75 |
| | | | | | 11055 | ♀ | 61 | 45 | 71 |
| | | | | | 11056 | ♀ | 64 | 43 | 73 |

TABLE OF SCALE COUNTS—ENDERBY ISLAND

| Number | Sex | Scale Rows | Crest | Belly | Number | Sex | Scale Rows | Crest | Belly |
|---|---|---|---|---|---|---|---|---|---|
| 11601 | ♂ | 71 | 41 | 68 | 11605 | ♀ | 70 | 45 | 75 |
| 11602 | ♂ | 73 | 39 | 77 | 11615 | ♀ | 72 | 44 | 73 |
| 11603 | ♂ | 67 | 43 | 67 | 11616 | ♀ | 73 | 46 | 72 |
| 11604 | ♂ | 69 | 41 | 74 | 11617 | ♀ | 70 | 43 | 73 |
| 11606 | ♂ | 72 | 40 | 73 | 11618 | ♀ | 77 | 41 | 75 |
| 11607 | ♂ | 67 | 36 | 69 | 11619 | ♀ | 74 | 42 | .. |
| 11608 | ♂ | 72 | 43 | 74 | 11620 | ♀ | 75 | 42 | 73 |
| 11609 | ♂ | 73 | 40 | 73 | 11621 | ♀ | 71 | 43 | 70 |
| 11610 | ♂ | 74 | 40 | 75 | 11622 | ♀ | 73 | 43 | 70 |
| 11611 | ♂ | 65 | 40 | 75 | 11623 | ♀ | 73 | 44 | 70 |
| 11612 | ♂ | 68 | 40 | 75 | 11624 | ♀ | 68 | 43 | 72 |
| 11613 | ♂ | 70 | 36 | 77 | 11625 | ♀ | 68 | 40 | 70 |
| 11614 | ♂ | 72 | 43 | 75 | 11626 | ♀ | 69 | 44 | 70 |
| | | | | | 11627 | ♀ | 71 | 42 | 74 |
| | | | | | 11628 | ♀ | 76 | 43 | 71 |
| | | | | | 11629 | ♀ | 67 | 45 | 71 |
| | | | | | 11630 | ♀ | 71 | 42 | 70 |
| | | | | | 11631 | ♀ | 71 | 46 | 70 |

*Habits.*—Charles Island, Oct. 4, 1905. Went ashore at Post Office Bay and worked toward the interior. The country is mountainous, but there are some large spaces of level land. Found animal life of every description scarce. I did not see a *Tropidurus* or a snake the whole day. Saw lots of cat tracks, so I suppose the lizards have been pretty well cleaned out, although there are beds of lava where they easily could escape by going underneath the blocks. Oct. 5. Went ashore on the northeast end of the island near the lagoon. Got one *Tropidurus,* and King got two, on a lava pile. King saw one more, but could not get it. Ochsner reports seeing one also, but failed to catch it. These were all that were seen by any of our party. Oct. 6. Went ashore for half a day at the lagoon on the northeast end of the island. Had better luck with the *Tropiduri,* getting five. They were in a large lava bed near the lagoon. Oct. 9. Went ashore at Black Beach, and worked into the interior up to some springs south of the highest peak. I saw no *Tropiduri* or snakes. Oct. 10. Worked up to the top of the crater on the highest mountain, but saw no reptiles whatever. *Tropidurus* is extremely rare on Charles. I have not seen any since we arrived at Black Beach. Feb. 26, 1906. Went ashore at Cormorant Bay and collected four *Tropiduri.* I saw seven altogether, but missed three on account of defective shells. The particular spot where

these lizards were taken is on a lava bed which surrounds the lagoon. No specimens were seen outside of this. They are very rare and shy, and at one's approach go under the lava and into crevices. Signs of cats are seen everywhere, and they probably are the principal cause of the scarcity.

Gardner-near-Charles, Oct. 2, 1905. Gardner Island is an old crater. We landed on the N.W. side, which is the only one accessible. It is very steep and covered with broken lava and cactus shrubs. *Tropiduri* were shy and not very common. They were found in about the same numbers from the rocks on the coast to the top of the crater. It was a bad place to hunt, and we stayed only a couple of hours, but secured fifteen *Tropiduri.*

Champion Island, Oct. 3, 1905. We then sailed on to Champion Island, which is a very small crater and easily got around. We covered this island in an hour and a half. *Tropiduri* were scarce here, and were found on the west side, where all the seals stayed, as there is a little beach there. There are lots of flies that go on the seals when they sleep on the beach, and the lizards, therefore, find more food at this place.

Enderby Island, May 14, 1906. This island is part of the ruin of an old crater and is composed of tufa. One side is too steep to work on, so we went only along the top. The only things seen in the way of reptiles were *Tropiduri* and a gecko. The former were fairly common. Thirty-one were secured in about an hour spent on the island.

### **Tropidurus albemarlensis barringtonensis** (Baur)

Barrington Island Lizard

1892, *Tropidurus barringtonensis,* BAUR, Festschrift für Leuckart, 1892, p. 268 (type locality **Barrington Island, Galapagos Archipelago).**
1903, *Tropidurus grayi barringtonensis,* HELLER, Proc. Washington Acad. Sci., V, 1903, p. 75.

*Diagnosis.*—Sides of neck granular, with numerous folds; hind legs of males without definite dark spots; interparietal plate usually much broader than long; not more than 76 scales around middle of body; scales smaller than in *T. albemarlensis,* 61 to 76 around middle of body.

*Type.*—Dr. Baur's original description was based upon thirty-eight specimens of this species from **Barrington Island.**

None of these were designated as types. I have been unable to learn their present location.

*Distribution.*—This lizard has been found only on Barrington Island, Galapagos Archipelago.

*Material.*—The Academy's collection contains one hundred and fifty-five specimens, of which fifty-seven males and seventy-four females have been included in the table of scale counts.

*Description of adult male No. 10196.*—The head is covered above with smooth scales; interparietal largest, broader than long; five or six large supraoculars; superciliaries imbricate; four superior and five inferior labials, to below middle of eye; rostral very broad and low; symphyseal broad, followed by a series of large sublabials, of which all but the first are separated from the infralabials by a row of smaller plates. Ear-opening large, with an anterior denticulation of four or five long, narrow scales. Side of neck between ear-opening and fore limb with numerous folds, covered with granular scales except on tops of folds. A strong antehumeral, but no complete gular, fold. A well-developed median dorsal crest begins half the length of the interparietal behind this plate, and runs continuously to and along the tail, being highest on the proximal fourth of the tail. The dorsal regions of the neck, body, and tail are covered with rather small, keeled, mucronate scales, which, on the body, change gradually to smaller, keeled, mucronate laterals. These again change gradually into the smooth ventrals, which are much smaller than the dorsals. The gular scales are smooth, smaller posteriorly, smallest below the ears. The scales on the chest are largest, smooth and imbricate. The limbs are provided above with keeled, and below with smooth scales. The posterior surface of the thigh is covered with weakly keeled, imbricate scales. The lateral caudals are strongly keeled and mucronate; while the inferior caudals are smooth proximally, but become keeled on the distal portion of the tail.

The color above is olive brown, somewhat mottled on the top and sides of the head. The dorsal surfaces of the body, neck, and fore limbs show numerous dark brown or black spots or cross-bars. The lower surfaces are greenish white, lightest on the chin. The gular region is suffused with dark gray, and the throat, chin and chest bear discrete, rounded spots of blackish brown.

| | | |
|---|---|---|
| Length to anus | mm. | 95 |
| Length of tail | | 113+ |
| Snout to ear | | 20 |
| Width of head | | 16 |
| Fore limb | | 41 |
| Hind limb | | 69 |
| Base of fifth to end of fourth toe | | 28 |
| Height of crest on nape | | 2 |
| Height of crest on midbody | | 1.5 |
| Height of crest on tail | | 2.8 |

*Coloration in life of adult male.*—Above light grayish brown, tail darker grayish; whole upper surface except the head spotted with blue-gray; the dorsum anteriorly and fore limbs black-barred and spotted; hind limbs and tail without dark bars. Head above olive green, grayish on sides and neck, black-spotted. A black antehumeral spot. Sides of

body behind the axilla reddish, black-barred and spotted; belly yellowish, spotted with pinkish and dusky on sides; breast and lower jaw brick red, spotted with black; chin yellowish without darker spots; throat black; fore limbs inferiorly red, black-spotted proximally like the breast; tail and hind limbs below light grayish green.

*Coloration in life of adult female.*—Above grayish brown, the dorsum crossed by dusky transverse bars; whole dorsal surface except head spotted with blue-gray; limbs above dusky-barred like back; head above olive brown, sides of snout grayish. Sides of head and neck from the eye to the antehumeral spot brick red; sides of body behind the axilla pinkish, obsoletely spotted with dusky; a black antehumeral spot. Belly and inferior surfaces of hind limbs and tail light grayish; breast lemon yellow, spotted with black; throat medially like the breast, spotted with dark brown; sides of body reddish; lower jaw pinkish, spotted with dusky; fore limbs inferiorly colored like breast, the forearm unspotted.

*Variation.*—The black spots on the back tend to form crossbars. Females are colored similarly to the males, but the black dorsal spots usually are somewhat smaller. The throat may be white with black spots, or may be suffused with gray. Large males may have some red on the throat; but this is seen in few specimens, and seems to be always absent in females. The interoccipital plate is wider than long. Variation in scale counts appears in the following table:

TABLE OF SCALE COUNTS—BARRINGTON ISLAND

| Number | Sex | Scale Rows | Crest | Belly | Number | Sex | Scale Rows | Crest | Belly |
|---|---|---|---|---|---|---|---|---|---|
| 10065 | ♂ | 67 | 52 | 72 | 10067 | ♀ | 63 | 48 | 76 |
| 10066 | ♂ | 68 | 48 | 76 | 10068 | ♀ | 67 | 49 | 74 |
| 10069 | ♂ | 66 | 46 | 77 | 10071 | ♀ | 63 | 50 | 72 |
| 10070 | ♂ | 65 | 50 | 72 | 10072 | ♀ | 67 | 52 | 74 |
| 10075 | ♂ | 65 | 52 | 77 | 10073 | ♀ | 69 | 51 | 71 |
| 10086 | ♂ | 63 | 47 | 75 | 10074 | ♀ | 65 | 51 | 75 |
| 10088 | ♂ | 71 | 50 | 80 | 10076 | ♀ | 66 | 51 | 72 |
| 10093 | ♂ | 69 | 54 | 78 | 10077 | ♀ | 62 | 45 | 70 |
| 10096 | ♂ | 70 | 52 | 79 | 10078 | ♀ | 63 | 54 | 75 |
| 10098 | ♂ | 65 | 53 | 79 | 10079 | ♀ | 71 | 52 | 73 |
| 10102 | ♂ | 68 | 50 | 76 | 10080 | ♀ | 64 | 49 | 74 |
| 10106 | ♂ | 67 | 48 | 78 | 10081 | ♀ | 67 | 49 | 80 |
| 10109 | ♂ | 68 | 52 | 76 | 10082 | ♀ | 61 | 49 | 71 |
| 10111 | ♂ | 63 | 49 | 74 | 10083 | ♀ | 70 | 48 | 76 |
| 10114 | ♂ | 66 | 48 | 76 | 10084 | ♀ | 67 | 50 | 77 |
| 10115 | ♂ | 62 | 48 | 73 | 10085 | ♀ | 65 | 48 | 76 |
| 10117 | ♂ | 67 | 50 | .. | 10087 | ♀ | 65 | 49 | 76 |

TABLE OF SCALE COUNTS—BARRINGTON ISLAND—*Continued*

| Number | Sex | Scale Rows | Crest | Belly |
|---|---|---|---|---|
| 10119 | ♂ | 70 | 51 | 80 |
| 10120 | ♂ | 68 | 50 | 80 |
| 10122 | ♂ | 68 | 53 | 79 |
| 10123 | ♂ | 64 | 49 | 77 |
| 10125 | ♂ | 65 | 50 | 79 |
| 10127 | ♂ | 62 | 47 | 76 |
| 10128 | ♂ | 63 | 51 | 79 |
| 10130 | ♂ | 61 | 45 | 73 |
| 10136 | ♂ | 66 | 52 | 76 |
| 10137 | ♂ | 63 | 48 | 74 |
| 10164 | ♂ | 66 | 48 | 77 |
| 10166 | ♂ | 64 | 54 | 77 |
| 10179 | ♂ | 65 | 48 | 78 |
| 10196 | ♂ | 66 | 47 | 77 |
| 10197 | ♂ | 66 | 50 | 75 |
| 12019 | ♂ | 66 | 51 | 79 |
| 12020 | ♂ | 66 | 54 | 77 |
| 12025 | ♂ | 65 | 48 | 73 |
| 12026 | ♂ | 64 | 49 | 79 |
| 12029 | ♂ | 68 | 48 | 80 |
| 12031 | ♂ | 63 | 48 | 74 |
| 12032 | ♂ | 72 | 54 | 82 |
| 12033 | ♂ | 68 | 50 | 79 |
| 12034 | ♂ | 66 | 51 | 77 |
| 12035 | ♂ | 67 | 50 | 78 |
| 12036 | ♂ | 66 | 51 | 76 |
| 12037 | ♂ | 64 | 51 | 72 |
| 12038 | ♂ | 71 | 53 | 78 |
| 12039 | ♂ | 64 | 48 | 75 |
| 12040 | ♂ | 66 | 51 | 71 |
| 12041 | ♂ | 66 | 51 | 75 |
| 12042 | ♂ | 62 | 55 | 74 |
| 12043 | ♂ | 66 | 58 | 73 |
| 12044 | ♂ | 68 | 52 | 76 |
| 12045 | ♂ | 67 | 51 | 75 |
| 12046 | ♂ | 67 | 47 | 70 |
| 12051 | ♂ | 63 | 49 | 70 |
| 12052 | ♂ | 65 | 46 | 73 |
| 12053 | ♂ | 68 | 50 | 78 |
| 12054 | ♂ | 65 | 50 | 78 |
| 10089 | ♀ | 64 | 50 | 70 |
| 10090 | ♀ | 69 | 47 | 73 |
| 10091 | ♀ | 66 | 52 | 74 |
| 10092 | ♀ | 68 | 48 | 76 |
| 10094 | ♀ | 64 | 56 | 80 |
| 10095 | ♀ | 67 | 51 | 73 |
| 10097 | ♀ | 71 | 48 | 71 |
| 10099 | ♀ | 69 | 51 | 75 |
| 10100 | ♀ | 69 | 54 | 74 |
| 10138 | ♀ | 66 | 48 | 76 |
| 10139 | ♀ | 65 | 48 | 77 |
| 10140 | ♀ | 63 | 48 | 70 |
| 10141 | ♀ | 61 | 49 | 77 |
| 10142 | ♀ | 67 | 52 | 77 |
| 10143 | ♀ | 67 | 48 | 79 |
| 10144 | ♀ | 67 | 49 | 73 |
| 10145 | ♀ | 66 | 48 | 76 |
| 10148 | ♀ | 65 | 45 | 77 |
| 10149 | ♀ | 67 | 47 | 79 |
| 10153 | ♀ | 69 | 50 | 76 |
| 10154 | ♀ | 63 | 50 | 73 |
| 10155 | ♀ | 67 | 50 | 77 |
| 10156 | ♀ | 64 | 52 | 74 |
| 10157 | ♀ | 65 | 50 | 76 |
| 10158 | ♀ | 66 | 47 | 70 |
| 10159 | ♀ | 65 | 48 | 75 |
| 10160 | ♀ | 66 | 49 | 78 |
| 10161 | ♀ | 64 | 47 | 72 |
| 10162 | ♀ | 69 | 49 | 75 |
| 10163 | ♀ | 65 | 45 | 73 |
| 10165 | ♀ | 64 | 51 | 74 |
| 10167 | ♀ | 63 | 50 | 72 |
| 10168 | ♀ | 66 | 47 | 72 |
| 10180 | ♀ | 66 | 49 | 74 |
| 10181 | ♀ | 65 | 50 | 76 |
| 10198 | ♀ | 66 | 46 | 77 |
| 10199 | ♀ | 70 | 46 | 78 |
| 10200 | ♀ | 67 | 52 | 76 |
| 10201 | ♀ | 68 | 48 | 74 |
| 10202 | ♀ | 64 | 48 | 75 |
| 10203 | ♀ | 71 | 52 | 75 |
| 10204 | ♀ | 68 | 48 | 74 |
| 10205 | ♀ | 64 | 44 | 74 |
| 10206 | ♀ | 64 | 45 | 72 |
| 10207 | ♀ | 67 | 48 | 71 |
| 10208 | ♀ | 70 | 51 | 80 |
| 10209 | ♀ | 68 | 49 | 75 |
| 10210 | ♀ | 71 | 46 | 76 |
| 10211 | ♀ | 64 | 44 | 75 |
| 12023 | ♀ | 67 | 49 | 77 |
| 12024 | ♀ | 69 | 50 | 80 |
| 12027 | ♀ | 64 | .. | 78 |
| 12030 | ♀ | 70 | 47 | 70 |
| 12047 | ♀ | 62 | 46 | 72 |
| 12048 | ♀ | 65 | 51 | 74 |
| 12049 | ♀ | 70 | 47 | 77 |
| 12050 | ♀ | 62 | 48 | 74 |

*Habits.*—Barrington Island, Oct. 20, 1905. Went ashore on the N.E. coast, and traveled about a mile to the iguana colony. *Tropiduri* were common near the beach, but plentiful inland. July 9, 1906. *Tropiduri* seem to be less abundant now than at the time of our former visit. July 10. Lizards are fairly abundant and rather wild.

"All stomachs examined contained insects, chiefly Orthoptera." (Heller.)

### **Tropidurus albemarlensis** Baur

Galapagos Lizard

? 1851, *Holotropis grayi,* Duméril, Cat. Méth, Rept., 1851, p. 70 (part); Duméril, Arch. d' Mus., VIII, p. 538 (part).

1871, *Craniopeltis grayii,* Peters, Mon. Berlin. Acad., 1871, p. 645 (part).

1876, *Tropidurus (Craniopeltis) grayii,* Steindachner, Festschr. Zool.-Bot. Ges. Wien, 1876, p. 310, pl. II, fig. 1 (part).

1877, *Liocephalus grayi,* Günther, Proc. Zool. Soc. Lond., 1877, p. 67 (part).

1885, *Tropidurus grayi,* Boulenger, Cat. Lizards, II, 1885, p. 172 (part); Cope, Proc. U. S. Nat. Mus., XII, 1889, p. 145 (part); Boulenger, Ann. and Mag. Nat. Hist., (6), VII, 1891, p. 502 (part).

1890, *Tropidurus albemarlensis,* Baur, Biol. Centralbl., X, p. 478; Baur, Festschrift für Leuckart, 1892, pp. 265, 269 (type locality, **Tagus Cove, Albemarle Island, Galapagos Archipelago).**

1890, *Tropidurus indefatigabilis,* Baur, Biol. Centralbl., X, p. 478; Baur, Festschrift für Leuckart, 1892, pp. 265, 268 (type locality, **Indefatigable Island, Galapagos Archipelago).**

1892, *Tropidurus jacobii,* Baur, Festschrift für Leuckart 1892, p. 269 (type locality **James Island, Galapagos Archipelago).**

1903, *Tropidurus grayi grayi,* Heller, Proc. Washington Acad. Sci., V, 1903, p. 69 (part).

1903, *Tropidurus grayi magnus,* Heller, Proc. Washington Acad. Sci., V, 1903, p. 74 (type locality **Narborough Island, Galapagos Archipelago).**

*Diagnosis.*—Sides of neck granular, with numerous folds; hind legs of males without definite dark spots; interparietal plate usually much broader than long; not more than 76 scales around middle of body; scales larger than in *T. albemarlensis barringtonensis,* 50 to 69 around middle of body.

*Types.*—Dr. Baur described *T. albemarlensis* from eleven specimens collected by the naturalists of the "Albatross" at **Tagus Cove, Albemarle Island,** in April, 1888. These lizards are Nos. 15003 to 15013 of the U. S. National Museum collection. *T. indefatigabilis* was described from ten examples from Indefatigable Island. *T. jacobii* was based upon a considerable number of specimens from James and Jervis islands. The type of Heller's *T. grayi magnus* was collected on Nar-

borough Island, and is No. 3974 in the collection of Leland Stanford Junior University.

*Distribution.*—This lizard has been collected on Indefatigable, South Seymour, Daphne, James, Jervis, Cowley, Brattle, Albemarle, and Narborough islands, Galapagos Archipelago. On Albemarle Island it has been found at Bank's Bay, Tagus Cove, Cowley Mountain, Iguana Cove, and the southeast coast near Vilamil or Turtle Cove.

*Material.*—The Academy's collection contains specimens about as follows:

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Indefatigable Island, | 72; | scales | counted | in | 24 | males, | 42 | females. |
| S. Seymour " | 47; | " | " | " | 12 | " | 31 | " |
| Daphne " | 52; | " | " | " | 27 | " | 24 | " |
| James " | 239; | " | " | " | 59 | " | 96 | " |
| Jervis " | 22; | " | " | " | 6 | " | 16 | " |
| Cowley " | 1; | " | " | " | 1 | " | 0 | " |
| Brattle " | 43; | " | " | " | 21 | " | 16 | " |
| Albemarle Island at: | | | | | | | | |
| Banks Bay | 50; | " | " | " | 12 | " | 34 | " |
| Tagus Cove | 45; | " | " | " | 18 | " | 26 | " |
| Cowley Mt. | 1; | " | " | " | 1 | " | 0 | " |
| Iguana Cove | 4; | " | " | " | 2 | " | 2 | " |
| Vilamil | 217; | " | " | " | 61 | " | 60 | " |
| Narborough Island | 101; | " | " | " | 41 | " | 51 | " |

*Description of adult male No. 12287,* Tagus Cove, Albemarle Island.—The head is covered above with smooth scales; interparietal largest, broader than long; five or six large superoculars; superciliaries imbricate; five superior and five inferior labials, to below middle of the eye; rostral very broad and low; symphyseal broad, followed by a series of large sublabials, of which all but the first are separated from the infralabials by a row of smaller plates. Ear-opening large, with an anterior denticulation of four or five long, narrow scales. Sides of neck between ear-opening and fore limb with numerous granular folds. A strong antehumeral, but no complete gular, fold. A well-developed median dorsal crest begins half the length of the interparietal behind this plate, and runs continuously to and along the tail, being highest on the proximal fourth of the tail. The dorsal regions of the neck, body, and tail are covered with rather small, keeled, mucronate scales, which, on the body, change gradually to smaller, keeled, mucronate laterals. These again change gradually into the smooth ventrals, which are much smaller than the dorsals. The gular scales are smooth, smaller centrally, smallest below the ears. The scales of the chest are largest, smooth and imbricate. The limbs are provided above with keeled, and below with smooth, scales. The posterior surface of the thigh is covered with imbricate scales, which, toward the dorsal surface of the thigh, become keeled. The lateral caudals are strongly keeled and mucronate; while the inferior caudals are smooth proximally, but become keeled on the distal portion of the tail.

The coloration in alcohol is olive brown above, spotted, except on the head, tail, and hind limbs, with small rounded, blackish spots, each covering one or more scales. The chin is yellowish. The throat is black. The other lower surfaces are greenish or yellowish, marked on the chin, gular region, chest, and sides of body with discrete, rounded spots of black or dark brown.

| | |
|---|---|
| Length to anus ..... mm. | 85 |
| Length of tail ..... | 116+ |
| Snout to ear ..... | 18 |
| Width of head ..... | 22.5 |
| Fore limb ..... | 35 |
| Hind limb ..... | 59 |
| Base of fifth to end of fourth toe ..... | 23 |
| Height of crest on nape ..... | 2 |
| Height of crest on midbody ..... | 2.2 |
| Height of crest on tail ..... | 3 |

*Coloration in life of adult female, Tagus Cove.*—"Above brown, spotted with lighter brown except on tail, which is grayish brown. Hind limbs like the tail, fore limbs colored like the back. Belly light grayish, hind limbs and tail inferiorly the same. Breast pale yellow spotted with black; throat dark, with yellow-edged scales; chin lighter, grayish, dusky spotted; infralabials and mental pinkish. Sides dull brick red, black-spotted; a dark stripe from the ear to the thigh, and another fainter one from the axilla to the thigh. Sides of head and neck brighter red, with a dark antehumeral spot."

*Coloration in life of adult male, Iguana Cove.*—"Above olive brown, flecked with pale greenish gray, dorsal crest like spots except on the nape, where it is dark-spotted; limbs above like the back. Head uniform brownish, sides of body the same, but dark-spotted. Sides of neck tinged with reddish; a black antehumeral spot. Belly pale greenish gray, bordered with brick red on the sides; limbs and tail inferiorly like the belly. Breast chrome yellow spotted with black, the throat clay-yellow, much spotted with black, mandible grayish, labials greenish."

"The males secured in Iguana Cove show much variation. Those inhabiting the light soil in brushy areas are lighter; in some, the breast being yellowish with a few scattered spots, and the throat grayish. Others taken near the beach, on black basaltic lavas, have the breast, throat, and mandible solid blackish, and the belly plumbeous. Some of the light specimens are considerably lighter above than the one described, the dorsal crest being entirely light grayish, and sides of the belly dark-spotted, with the dark markings of the back arranged in transverse bars."

*Coloration in life of adult female, Iguana Cove.*—"Much darker brown above than the male, with light dorsal crest,

black-spotted above; tail somewhat lighter, with a greenish dorsal crest and light spots; fore limbs like the back; hind limbs like the tail, light-spotted. Belly pale greenish gray, breast golden, black-spotted; throat and mandible brick red. Tail and hind limbs inferiorly like the belly; fore limbs like the breast, black-spotted. Sides of throat, mandible, and body brick red; a black antehumeral spot."

*Coloration in life of three adult males, James Island.*—1) "Above dark brown, spotted with blackish and light grayish spots; dorsal crest and the scales at its base light grayish; hind limbs and tail above lighter dusky brown, the former light-spotted; head above olive brown. Belly, thighs, and tail inferiorly light grayish; breast buffy and pinkish, sparingly black-spotted; throat black, mandible pinkish, black-spotted posteriorly. Sides of head light brownish, preoculars light-spotted, lower eyelid bluish; sides of neck bright red, black-spotted; a black antehumeral spot, light-bordered anteriorly; shoulders blotched with yellowish and brown. Sides of the body lake red, spotted with black and whitish spots except about the axilla and along the sides of the belly."

2) "The back is brownish, with black spots which extend down to the light bluish coloration below. Dorsal crest very prominent, of a light greenish tint. Sides of neck reddish, with black spots. Black blotches in front of each shoulder. Chin and lower jaw pale red. Gular region black. Chest with faint black spots. Below light blue."

3) "Back brown with scattered black spots. Upper surface of fore limbs also with black spots. Folds on neck red with large black spots. Antehumeral spot black, larger than in females. Chin light straw color with a few small black spots. Gular region black. Chest brick red with small black spots. Belly and lower surfaces of hind limbs and tail dull light blue."

*Coloration in life of three adult females, James Island.*—1) "Above golden-brown, crest grayish-white, nape and tail lighter without golden coloration; limbs above like dorsum. A dark brown band, two scales wide, extending from the ear

to above the thigh; a lighter or fainter one from the axilla to the thigh. Belly, hind limbs, and tail inferiorly light grayish; breast, throat, and mandible canary yellow, black-spotted. Sides of head orange red; sides of neck and body red, brightest anteriorly, lake red posteriorly, on body the scales light-edged, sparingly dark-spotted; a black antehumeral spot."

2) "Back brownish. Sides of neck reddish with black blotch in front of shoulder. Gular region lemon color with black spots. Lower surfaces pale blue."

3) "Back light bronze. A row of small black spots runs along the side, starting behind the fore limb and ending a little in front of the hind limb. The folds on the side of the neck are brick red. There is a black antehumeral spot. Throat and chest bright lemon color with black spots. Belly and lower surfaces of hind limbs and tail dull light bluish."

*Variation.*—Although the lizards which are here included under one name have been described as several distinct species, we have not been able to find any differences which are constant enough to justify us in making any division. The scale counts agree quite closely in specimens from all these islands. Females from South Seymour and Indefatigable islands show most red suffusion about the chin and throat, but red is shown also by specimens from Daphne, James, Jervis, and Albemarle islands. Jervis and Seymour specimens of both sexes may show red. Specimens from Indefatigable Island vary but little. The black dorsal spots may be present or absent on females, but are constant on males.. Gular folds and under surface of shoulders in both sexes may show a faint coloring of red. Interoccipital wider than long.

South Seymour Island. Females may have indistinct dorsal markings, otherwise there is little variation. The gular folds and sides of the belly back of the shoulders are distinctly marked with red, those without it being the exception. The males have all the under surface of shoulders and chin distinctly marked with red spotted with black. Throats of females are white, spotted with black. Interoccipital wider than long.

Daphne Island. Black cross-bars over the shoulders and black spots on the front limbs are present in males, but always absent in females. Throats of males are always black, while those of females are white, spotted with black. Some specimens may have a slight showing of red on the gular folds. This rarely occurs, but may be seen in either sex. Interoccipital wider than long.

James Island. Females lack the black throat which is constantly present in the males. They may be sparingly spotted with black, but usually are uniform brown. Throats may be white or grayish, spotted with black. Gular folds may have a slight showing of red, but this occurs more often in the females. Interoccipital wider than long.

Jervis Island. Females with or without indistinct dorsal spots. Adult males show red on sides of the belly just back of the shoulders. Interoccipital wider than long.

Brattle Island. Specimens show little variation. The throats of females are, as usual, white or grayish, spotted with black. The black dorsal spots are present in some females, but not as prominent as in the males. Interoccipital wider than long.

Bank's Bay, Albemarle Island. Females may show indistinct dorsal spotting, which is constant in the males. Throats may be red or slate color, spotted with black. Some female specimens have the gular folds and sides of the belly reddish spotted with black. Some few males have red coloring like the females, but not so bright. Interoccipital wider than long.

Tagus Cove, Albemarle Island. Females may have throats white or grayish, spotted with black, and some specimens are faintly red on gular folds. They may have faint dorsal markings similar to the prominent ones of the males. Interoccipital wider than long.

Vilamil, Albemarle Island. Females differ little in coloration, but a few may have red on the gular folds and a trace on top of the head. The throats are white or grayish, spotted with black. A black blotch in front of the shoulders is common in both sexes. The black dorsal spots are constant in males, but rare and indistinct in females. Interoccipital usually wider than long.

Narborough Island. Throats of females may be either slate color or blackish like the under surfaces of the body, with or without black spots. Those of males are usually black, but may be slate color with large black spots. The black dorsal spots are present in both sexes, but indistinct in the females. Some females may have a very faint showing of red along the sides of the belly. Interoccipital wider than long.

TABLE OF SCALE COUNTS—INDEFATIGABLE ISLAND

| Number | Sex | Scale Rows | Crest | Belly |
|---|---|---|---|---|
| 10228 | ♂ | 53 | 40 | 67 |
| 10229 | ♂ | 56 | 44 | 67 |
| 10373 | ♂ | 55 | 47 | 66 |
| 10376 | ♂ | 55 | 44 | 59 |
| 10377 | ♂ | 55 | 41 | 67 |
| 10385 | ♂ | 53 | 42 | 61 |
| 10386 | ♂ | 53 | 42 | 63 |
| 10391 | ♂ | 54 | 47 | 65 |
| 10394 | ♂ | 56 | 38 | 65 |
| 10398 | ♂ | 53 | 43 | 64 |
| 10399 | ♂ | 57 | 43 | 68 |
| 10403 | ♂ | 57 | 44 | 66 |
| 10407 | ♂ | 56 | 43 | 65 |
| 10410 | ♂ | 56 | 42 | 67 |
| 10419 | ♂ | 56 | 44 | 67 |
| 10424 | ♂ | 56 | 40 | 68 |
| 10546 | ♂ | 54 | 41 | 66 |
| 10549 | ♂ | 55 | 43 | 63 |
| 10550 | ♂ | 54 | 47 | 63 |
| 10551 | ♂ | 54 | 40 | 67 |
| 10552 | ♂ | 53 | 42 | 61 |
| 10793 | ♂ | 54 | 44 | 63 |
| 12066 | ♂ | 53 | 46 | 60 |
| 12067 | ♂ | 54 | 40 | 69 |

| Number | Sex | Scale Rows | Crest | Belly |
|---|---|---|---|---|
| 10236 | ♀ | 56 | 42 | 67 |
| 10374 | ♀ | 52 | .. | 69 |
| 10382 | ♀ | 55 | 45 | 68 |
| 10384 | ♀ | 56 | 43 | 60 |
| 10389 | ♀ | 57 | 48 | 65 |
| 10390 | ♀ | 57 | 43 | 68 |
| 10392 | ♀ | 56 | 44 | 63 |
| 10397 | ♀ | 57 | 40 | 60 |
| 10400 | ♀ | 56 | 41 | 68 |
| 10401 | ♀ | 54 | 43 | 64 |
| 10402 | ♀ | 55 | 42 | 63 |
| 10404 | ♀ | 57 | 42 | 67 |
| 10405 | ♀ | 56 | 41 | 68 |
| 10406 | ♀ | 55 | 40 | 62 |
| 10408 | ♀ | 57 | .. | 68 |
| 10409 | ♀ | 55 | 40 | 66 |
| 10411 | ♀ | 54 | 47 | 68 |
| 10412 | ♀ | 53 | 44 | 60 |
| 10413 | ♀ | 53 | 40 | 64 |
| 10414 | ♀ | 55 | 41 | 66 |
| 10415 | ♀ | 52 | 41 | 62 |
| 10416 | ♀ | 57 | 43 | 67 |
| 10417 | ♀ | 57 | 43 | 67 |
| 10418 | ♀ | 57 | 41 | 66 |
| 10420 | ♀ | 53 | 40 | 63 |
| 10421 | ♀ | 57 | 43 | 64 |
| 10422 | ♀ | 54 | 42 | 66 |
| 10423 | ♀ | 53 | 42 | 63 |
| 10425 | ♀ | 57 | .. | 65 |
| 10426 | ♀ | 52 | 40 | 62 |
| 10427 | ♀ | 54 | .. | 64 |
| 10547 | ♀ | 53 | 43 | 64 |
| 10548 | ♀ | 56 | 42 | 69 |
| 10553 | ♀ | 50 | 40 | 62 |
| 10554 | ♀ | 54 | 41 | 66 |
| 10555 | ♀ | 55 | 41 | 63 |
| 10556 | ♀ | 56 | 44 | 69 |
| 10557 | ♀ | 54 | 44 | 63 |
| 10558 | ♀ | 55 | 43 | 64 |
| 10794 | ♀ | 57 | 40 | 65 |
| 12068 | ♀ | 55 | .. | 68 |
| 12069 | ♀ | 55 | 40 | 64 |

TABLE OF SCALE COUNTS—SOUTH SEYMOUR ISLAND

| Number | Sex | Scale Rows | Crest | Belly |
|---|---|---|---|---|
| 10434 | ♂ | 56 | 44 | 69 |
| 10435 | ♂ | 56 | 46 | 68 |
| 10439 | ♂ | 59 | 41 | 68 |
| 10440 | ♂ | 54 | 38 | 68 |
| 10445 | ♂ | 56 | 45 | 73 |
| 10456 | ♂ | 54 | 39 | 68 |
| 10457 | ♂ | 60 | 42 | 71 |
| 10458 | ♂ | 52 | 41 | 66 |
| 10480 | ♂ | 52 | 39 | 68 |
| 10481 | ♂ | 59 | 43 | 69 |
| 12080 | ♂ | 55 | 44 | 67 |
| 12081 | ♂ | 54 | 43 | 68 |
| 10430 | ♀ | 56 | 45 | 66 |
| 10431 | ♀ | 57 | 44 | 67 |
| 10432 | ♀ | 52 | 46 | 66 |
| 10436 | ♀ | 55 | 43 | 66 |
| 10438 | ♀ | 55 | .. | 68 |
| 10441 | ♀ | 57 | 44 | 69 |
| 10443 | ♀ | 54 | 44 | 66 |
| 10444 | ♀ | 57 | 46 | 72 |
| 10446 | ♀ | 54 | 43 | 66 |
| 10447 | ♀ | 55 | 45 | 66 |
| 10448 | ♀ | 57 | 42 | 65 |
| 10449 | ♀ | 57 | 40 | 69 |
| 10450 | ♀ | 54 | 41 | 66 |
| 10451 | ♀ | 55 | 44 | 65 |
| 10452 | ♀ | 60 | 46 | .. |
| 10453 | ♀ | 60 | 40 | 71 |
| 10454 | ♀ | 57 | .. | 69 |
| 10455 | ♀ | 58 | 44 | 68 |
| 10459 | ♀ | 55 | 44 | 69 |
| 10460 | ♀ | 58 | 40 | 70 |
| 10461 | ♀ | 56 | 45 | 67 |
| 10462 | ♀ | 56 | 45 | 66 |
| 10463 | ♀ | 57 | 44 | 70 |
| 10464 | ♀ | 60 | 42 | 66 |
| 10465 | ♀ | 55 | 44 | 66 |
| 10466 | ♀ | 58 | 41 | 70 |
| 10467 | ♀ | 58 | 42 | 67 |
| 10468 | ♀ | 58 | 45 | 67 |
| 10469 | ♀ | 56 | .. | 65 |
| 10470 | ♀ | 59 | 44 | 65 |
| 10471 | ♀ | 55 | 45 | 67 |

TABLE OF SCALE COUNTS—DAPHNE ISLAND

| Number | Sex | Scale Rows | Crest | Belly |
|---|---|---|---|---|
| 10487 | ♂ | 61 | 47 | 72 |
| 10488 | ♂ | 59 | 44 | 72 |
| 10489 | ♂ | 61 | 43 | 72 |
| 10490 | ♂ | 59 | 49 | 71 |
| 10491 | ♂ | 62 | 49 | 72 |
| 10496 | ♂ | 65 | 46 | 72 |
| 10497 | ♂ | 58 | 48 | 72 |
| 10500 | ♂ | 62 | 47 | 72 |
| 10503 | ♂ | 61 | 48 | 70 |
| 10505 | ♂ | 62 | 44 | 72 |
| 10509 | ♂ | 64 | 45 | 73 |
| 10510 | ♂ | 62 | 48 | 70 |
| 10511 | ♂ | 58 | 47 | 71 |
| 10513 | ♂ | 60 | 46 | 70 |
| 10514 | ♂ | 63 | 47 | 71 |
| 10518 | ♂ | 63 | 47 | 74 |
| 10519 | ♂ | 65 | 49 | 71 |
| 10520 | ♂ | 61 | 44 | 73 |
| 10492 | ♀ | 60 | 49 | 70 |
| 10493 | ♀ | 60 | 45 | 71 |
| 10494 | ♀ | 63 | 44 | 72 |
| 10498 | ♀ | 65 | 44 | 71 |
| 10499 | ♀ | 64 | 47 | 71 |
| 10501 | ♀ | 65 | 43 | 71 |
| 10502 | ♀ | 63 | 48 | 71 |
| 10504 | ♀ | 62 | 51 | 72 |
| 10506 | ♀ | 63 | 48 | 70 |
| 10507 | ♀ | 65 | 47 | 71 |
| 10508 | ♀ | 55 | 45 | 66 |
| 10512 | ♀ | 61 | 47 | 72 |
| 10515 | ♀ | 66 | 46 | 72 |
| 10516 | ♀ | 61 | 50 | 75 |
| 10517 | ♀ | 63 | 45 | 70 |
| 10521 | ♀ | 63 | 44 | 70 |
| 10524 | ♀ | 66 | 50 | 72 |
| 10526 | ♀ | 62 | 44 | .. |

TABLE OF SCALE COUNTS—DAPHNE ISLAND—*Continued*

| Number | Sex | Scale Rows | Crest | Belly | Number | Sex | Scale Rows | Crest | Belly |
|---|---|---|---|---|---|---|---|---|---|
| 10522 | ♂ | 61 | 48 | 74 | 10528 | ♀ | 61 | 49 | 70 |
| 10523 | ♂ | 61 | 46 | 72 | 10531 | ♀ | 60 | 43 | 68 |
| 10525 | ♂ | 62 | 44 | 70 | 10534 | ♀ | 65 | 49 | 73 |
| 10527 | ♂ | 62 | .. | 73 | 10536 | ♀ | 66 | 46 | 72 |
| 10529 | ♂ | 58 | 45 | 68 | 10537 | ♀ | 65 | 48 | 72 |
| 10530 | ♂ | 60 | 47 | 72 | 10538 | ♀ | 60 | 49 | 72 |
| 10532 | ♂ | 62 | 45 | 69 | | | | | |
| 10533 | ♂ | 59 | 47 | 68 | | | | | |
| 10535 | ♂ | 60 | .. | 71 | | | | | |

TABLE OF SCALE COUNTS—JAMES ISLAND

| Number | Sex | Scale Rows | Crest | Belly | Number | Sex | Scale Rows | Crest | Belly |
|---|---|---|---|---|---|---|---|---|---|
| 10587 | ♂ | 58 | 39 | 75 | 10593 | ♀ | 63 | 43 | 74 |
| 10588 | ♂ | 67 | 43 | 74 | 10595 | ♀ | 63 | 42 | 72 |
| 10591 | ♂ | 63 | 40 | 74 | 10596 | ♀ | 60 | 43 | 72 |
| 10592 | ♂ | 64 | .. | 73 | 10597 | ♀ | 60 | 41 | 72 |
| 10594 | ♂ | 54 | 40 | 68 | 10599 | ♀ | 64 | 43 | 74 |
| 10602 | ♂ | 63 | 42 | 72 | 10604 | ♀ | 63 | 42 | 74 |
| 10618 | ♂ | 60 | 41 | 73 | 10619 | ♀ | 58 | 41 | 72 |
| 10624 | ♂ | 60 | 40 | 68 | 10620 | ♀ | 61 | 43 | 72 |
| 10631 | ♂ | 60 | 46 | 70 | 10621 | ♀ | 55 | .. | 70 |
| 10635 | ♂ | 58 | 42 | 70 | 10622 | ♀ | 60 | 44 | 74 |
| 10652 | ♂ | 61 | 43 | 68 | 10623 | ♀ | 59 | 42 | 70 |
| 10653 | ♂ | 59 | 42 | 66 | 10625 | ♀ | 62 | 37 | 68 |
| 10655 | ♂ | 62 | 38 | 70 | 10627 | ♀ | 61 | 42 | 69 |
| 10656 | ♂ | 59 | 45 | 66 | 10628 | ♀ | 61 | 40 | 74 |
| 10657 | ♂ | 58 | 38 | 70 | 10629 | ♀ | 59 | 42 | 69 |
| 10658 | ♂ | 62 | 41 | 77 | 10630 | ♀ | 59 | 43 | 68 |
| 10661 | ♂ | 56 | 40 | 73 | 10632 | ♀ | 61 | 44 | 68 |
| 10662 | ♂ | 62 | 43 | 70 | 10633 | ♀ | 62 | 40 | 71 |
| 10666 | ♂ | 63 | 42 | 68 | 10634 | ♀ | 58 | .. | 74 |
| 10667 | ♂ | 57 | 44 | 76 | 10636 | ♀ | 60 | 44 | 73 |
| 10669 | ♂ | 60 | 39 | 73 | 10637 | ♀ | 57 | 44 | 71 |
| 10670 | ♂ | 63 | 42 | 69 | 10638 | ♀ | 58 | 38 | 68 |
| 10672 | ♂ | 60 | 44 | 74 | 10639 | ♀ | 56 | 42 | 66 |
| 10673 | ♂ | 58 | 42 | 71 | 10640 | ♀ | 62 | 44 | 75 |
| 10674 | ♂ | 60 | 43 | 69 | 10641 | ♀ | 52 | .. | 69 |
| 10676 | ♂ | 64 | 46 | 79 | 10642 | ♀ | 62 | 44 | 72 |
| 10678 | ♂ | 61 | 42 | 70 | 10643 | ♀ | 59 | 42 | 73 |
| 10681 | ♂ | 58 | 40 | 70 | 10644 | ♀ | 59 | 44 | 73 |
| 10682 | ♂ | 57 | 47 | 73 | 10646 | ♀ | 63 | 42 | 72 |
| 10683 | ♂ | 58 | 42 | 71 | 10647 | ♀ | 61 | 44 | 71 |
| 10684 | ♂ | 60 | 40 | 69 | 10648 | ♀ | 57 | 42 | 68 |
| 10691 | ♂ | 63 | 39 | 73 | 10649 | ♀ | 59 | 43 | 72 |
| 10694 | ♂ | 62 | 43 | 77 | 10650 | ♀ | 63 | 41 | 73 |
| 10695 | ♂ | 59 | 39 | 69 | 10654 | ♀ | 61 | 39 | 73 |
| 10698 | ♂ | 60 | 42 | 71 | 10659 | ♀ | 59 | 43 | 71 |
| 10700 | ♂ | 64 | 43 | 72 | 10660 | ♀ | 60 | 43 | 68 |
| 10706 | ♂ | 58 | 45 | 74 | 10663 | ♀ | 58 | 41 | 72 |
| 10707 | ♂ | 64 | 42 | 71 | 10664 | ♀ | 57 | 40 | 68 |
| 10708 | ♂ | 60 | 42 | 69 | 10665 | ♀ | 56 | 44 | 68 |
| 10713 | ♂ | 60 | 42 | 70 | 10668 | ♀ | 63 | 43 | 74 |

TABLE OF SCALE COUNTS—JAMES ISLAND—*Continued*

| Number | Sex | Scale Rows | Crest | Belly |
|---|---|---|---|---|
| 10720 | ♂ | 59 | 38 | 71 |
| 10723 | ♂ | 58 | 40 | 70 |
| 10735 | ♂ | 64 | 42 | 70 |
| 10737 | ♂ | 60 | 44 | 75 |
| 10739 | ♂ | 61 | 40 | 71 |
| 10740 | ♂ | 60 | 37 | 72 |
| 10741 | ♂ | 61 | 43 | 67 |
| 10742 | ♂ | 58 | 43 | 71 |
| 10743 | ♂ | 64 | 44 | 68 |
| 10747 | ♂ | 60 | 42 | 70 |
| 10748 | ♂ | 59 | 44 | 70 |
| 12101 | ♂ | 62 | 40 | 71 |
| 12103 | ♂ | 61 | .. | 68 |
| 12107 | ♂ | 57 | 35 | 71 |
| 12108 | ♂ | 60 | 40 | 72 |
| 12109 | ♂ | 57 | 41 | 70 |
| 12125 | ♂ | 56 | 41 | 68 |
| 12132 | ♂ | 61 | 45 | 74 |
| 12133 | ♂ | 58 | 46 | 74 |
| 10675 | ♀ | 58 | 42 | 70 |
| 10677 | ♀ | 62 | 42 | 70 |
| 10679 | ♀ | 63 | 43 | 70 |
| 10680 | ♀ | 64 | 43 | 70 |
| 10685 | ♀ | 59 | 40 | 67 |
| 10686 | ♀ | 62 | 37 | 75 |
| 10687 | ♀ | 58 | .. | 72 |
| 10688 | ♀ | 64 | 40 | 68 |
| 10689 | ♀ | 56 | 44 | 72 |
| 10690 | ♀ | 60 | 43 | 70 |
| 10692 | ♀ | 57 | 42 | 70 |
| 10693 | ♀ | 64 | 44 | 73 |
| 10696 | ♀ | 60 | 42 | 74 |
| 10697 | ♀ | 61 | 42 | 72 |
| 10699 | ♀ | 60 | 40 | 73 |
| 10701 | ♀ | 61 | 41 | 72 |
| 10702 | ♀ | 61 | 42 | 71 |
| 10705 | ♀ | 60 | 40 | 72 |
| 10709 | ♀ | 60 | 40 | 74 |
| 10711 | ♀ | 61 | 46 | 69 |
| 10712 | ♀ | 63 | 44 | 75 |
| 10714 | ♀ | 63 | 41 | 75 |
| 10715 | ♀ | 57 | 41 | 67 |
| 10716 | ♀ | 59 | 44 | 69 |
| 10717 | ♀ | 61 | 40 | 71 |
| 10718 | ♀ | 61 | 38 | 70 |
| 10751 | ♀ | 62 | 43 | 70 |
| 10755 | ♀ | 62 | 43 | 67 |
| 10757 | ♀ | 60 | 43 | 70 |
| 10760 | ♀ | 61 | 42 | 73 |
| 10761 | ♀ | 61 | 43 | 72 |
| 10762 | ♀ | 61 | 43 | 70 |
| 10764 | ♀ | 58 | 42 | 69 |
| 10768 | ♀ | 56 | 44 | 68 |
| 10769 | ♀ | 62 | 41 | 74 |
| 10772 | ♀ | 62 | 40 | 72 |
| 10773 | ♀ | 60 | 44 | 70 |
| 10778 | ♀ | 56 | 39 | 65 |
| 12099 | ♀ | 62 | 41 | 76 |
| 12100 | ♀ | 62 | 41 | 77 |
| 12102 | ♀ | 64 | 42 | 77 |
| 12104 | ♀ | 57 | 44 | 73 |
| 12105 | ♀ | 60 | 41 | 69 |
| 12106 | ♀ | 61 | 37 | 73 |
| 12110 | ♀ | 63 | 42 | 74 |
| 12111 | ♀ | 61 | 43 | 77 |
| 12112 | ♀ | 59 | 41 | 73 |
| 12113 | ♀ | 58 | 35 | 74 |
| 12114 | ♀ | 61 | 41 | 73 |
| 12115 | ♀ | 60 | 39 | 71 |
| 12124 | ♀ | 60 | 42 | 69 |
| 12126 | ♀ | 63 | 43 | 71 |
| 12127 | ♀ | 61 | 41 | 72 |
| 12129 | ♀ | 59 | 40 | 68 |
| 12130 | ♀ | 61 | 41 | 72 |
| 12131 | ♀ | 60 | 43 | 71 |

TABLE OF SCALE COUNTS—Jervis Island

| Number | Sex | Scale Rows | Crest | Belly |
|---|---|---|---|---|
| 10574 | ♂ | 65 | 43 | 71 |
| 10575 | ♂ | 64 | 41 | 72 |
| 10577 | ♂ | 62 | 40 | 70 |
| 10578 | ♂ | 68 | 40 | 76 |
| 10607 | ♂ | 64 | 48 | 77 |
| 10608 | ♂ | 61 | 43 | 71 |
| 10569 | ♀ | 63 | 43 | 71 |
| 10570 | ♀ | 60 | 46 | 71 |
| 10571 | ♀ | 60 | 38 | 72 |
| 10572 | ♀ | 60 | 39 | 70 |
| 10573 | ♀ | 65 | 43 | 74 |
| 10576 | ♀ | 61 | 42 | 71 |
| 10579 | ♀ | 61 | 43 | 70 |
| 10580 | ♀ | 62 | 45 | 69 |
| 10581 | ♀ | 60 | 42 | 70 |
| 10582 | ♀ | 62 | 43 | 70 |
| 10583 | ♀ | 59 | 42 | 64 |
| 10584 | ♀ | 69 | 40 | 76 |
| 10585 | ♀ | 60 | 43 | 70 |
| 10586 | ♀ | 61 | 39 | 69 |
| 10606 | ♀ | 63 | 42 | 75 |
| 10609 | ♀ | 65 | 40 | 75 |

TABLE OF SCALE COUNTS—Brattle Island

| Number | Sex | Scale Rows | Crest | Belly |
|---|---|---|---|---|
| 10238 | ♂ | 61 | 43 | 66 |
| 10239 | ♂ | 64 | 40 | 66 |
| 10240 | ♂ | 62 | 41 | 67 |
| 10241 | ♂ | 64 | 41 | 67 |
| 10243 | ♂ | 64 | 42 | 65 |
| 10246 | ♂ | 63 | 41 | 69 |
| 10247 | ♂ | 61 | 40 | 65 |
| 10248 | ♂ | 61 | 39 | 66 |
| 10250 | ♂ | 67 | 40 | 67 |
| 10251 | ♂ | 61 | 40 | 63 |
| 10255 | ♂ | 63 | 38 | 67 |
| 10257 | ♂ | 66 | 44 | 69 |
| 10259 | ♂ | 62 | 39 | 67 |
| 10260 | ♂ | 61 | 37 | 66 |
| 10261 | ♂ | 63 | 40 | 65 |
| 10264 | ♂ | 62 | 42 | 67 |
| 10266 | ♂ | 61 | 40 | 66 |
| 10268 | ♂ | 63 | 40 | 66 |
| 10269 | ♂ | 62 | 40 | 64 |
| 10272 | ♂ | 63 | 41 | 65 |
| 10275 | ♂ | 65 | 42 | 65 |
| 10237 | ♀ | 60 | 40 | 67 |
| 10242 | ♀ | 61 | 40 | 67 |
| 10245 | ♀ | 61 | 42 | 69 |
| 10249 | ♀ | 61 | 38 | 64 |
| 10252 | ♀ | 60 | 40 | 68 |
| 10253 | ♀ | 60 | 40 | 64 |
| 10254 | ♀ | 62 | 41 | 67 |
| 10258 | ♀ | 62 | 42 | 64 |
| 10262 | ♀ | 61 | 40 | 68 |
| 10263 | ♀ | 62 | 39 | 68 |
| 10267 | ♀ | 61 | 45 | 68 |
| 10270 | ♀ | 67 | 38 | 69 |
| 10274 | ♀ | 65 | 43 | 69 |
| 10276 | ♀ | 59 | 39 | 66 |
| 10277 | ♀ | 65 | 40 | 68 |
| 10278 | ♀ | 61 | .. | 63 |

TABLE OF SCALE COUNTS—Cowley Island

| Number | Sex | Scale Rows | Crest | Belly |
|---|---|---|---|---|
| 12167 | ♂ | 61 | 42 | 67 |

TABLE OF SCALE COUNTS—BANK'S BAY, ALBEMARLE ISLAND

| Number | Sex | Scale Rows | Crest | Belly |
|---|---|---|---|---|
| 11356 | ♂ | 58 | 35 | 60 |
| 11358 | ♂ | 59 | 37 | 62 |
| 11385 | ♂ | 58 | 42 | 63 |
| 11388 | ♂ | 57 | 39 | 66 |
| 11389 | ♂ | 63 | 39 | 63 |
| 11390 | ♂ | 62 | 36 | 64 |
| 11391 | ♂ | 59 | 39 | 60 |
| 11396 | ♂ | 63 | 39 | 63 |
| 11397 | ♂ | 58 | 40 | 62 |
| 11400 | ♂ | 60 | 43 | 68 |
| 11401 | ♂ | 59 | 40 | 63 |
| 11429 | ♂ | 60 | 40 | 66 |
| 11355 | ♀ | 58 | 37 | 64 |
| 11357 | ♀ | 58 | 41 | 61 |
| 11360 | ♀ | 62 | 38 | 68 |
| 11361 | ♀ | 60 | 40 | 63 |
| 11362 | ♀ | 61 | 43 | 68 |
| 11363 | ♀ | 56 | 38 | 64 |
| 11364 | ♀ | 58 | 36 | 61 |
| 11365 | ♀ | 62 | 39 | 67 |
| 11384 | ♀ | 55 | 41 | 61 |
| 11386 | ♀ | 59 | 39 | 63 |
| 11387 | ♀ | 59 | 38 | 60 |
| 11392 | ♀ | 61 | 39 | 55 |
| 11395 | ♀ | 57 | 40 | 66 |
| 11398 | ♀ | 61 | 43 | 64 |
| 11402 | ♀ | 63 | 43 | 65 |
| 11403 | ♀ | 57 | 37 | 61 |
| 11404 | ♀ | 58 | 39 | 64 |
| 11406 | ♀ | 58 | 37 | 63 |
| 11407 | ♀ | 64 | 40 | 67 |
| 11408 | ♀ | 59 | 36 | 67 |
| 11409 | ♀ | 64 | 43 | 67 |
| 11410 | ♀ | 61 | 38 | 60 |
| 11411 | ♀ | 57 | 40 | 65 |
| 11414 | ♀ | 64 | 39 | 66 |
| 11416 | ♀ | 59 | 39 | 66 |
| 11417 | ♀ | 58 | 45 | 68 |
| 11418 | ♀ | 60 | 38 | 68 |
| 11420 | ♀ | 63 | 39 | 65 |
| 11421 | ♀ | 57 | 41 | 62 |
| 11424 | ♀ | 61 | 42 | 62 |
| 11425 | ♀ | 58 | 39 | 65 |
| 11426 | ♀ | 62 | 37 | 61 |
| 11427 | ♀ | 60 | 36 | 65 |
| 11428 | ♀ | 58 | 40 | 66 |

TABLE OF SCALE COUNTS—TAGUS COVE, ALBEMARLE ISLAND

| Number | Sex | Scale Rows | Crest | Belly |
|---|---|---|---|---|
| 11275 | ♂ | 59 | 35 | 63 |
| 11276 | ♂ | 58 | 36 | 65 |
| 11278 | ♂ | 60 | 33 | 65 |
| 11280 | ♂ | 57 | 34 | 63 |
| 11281 | ♂ | 62 | 41 | 65 |
| 11284 | ♂ | 60 | 38 | 62 |
| 11287 | ♂ | 58 | 40 | 63 |
| 11289 | ♂ | 59 | 38 | 68 |
| 11291 | ♂ | 60 | 38 | 65 |
| 11294 | ♂ | 60 | 39 | 58 |
| 11295 | ♂ | 60 | 35 | 60 |
| 11296 | ♂ | 61 | 36 | 66 |
| 11297 | ♂ | 60 | 40 | 65 |
| 11302 | ♂ | 58 | 34 | 61 |
| 11370 | ♂ | 58 | 37 | 59 |
| 11277 | ♀ | 59 | 36 | 63 |
| 11279 | ♀ | 60 | 39 | 64 |
| 11282 | ♀ | 58 | 38 | 63 |
| 11283 | ♀ | 57 | 41 | 60 |
| 11285 | ♀ | 58 | 42 | 64 |
| 11286 | ♀ | 61 | 39 | 65 |
| 11288 | ♀ | 60 | 36 | 60 |
| 11290 | ♀ | 58 | 35 | 62 |
| 11292 | ♀ | 56 | 36 | 63 |
| 11293 | ♀ | 58 | 37 | 62 |
| 11298 | ♀ | 57 | 40 | 64 |
| 11299 | ♀ | 57 | 43 | 62 |
| 11301 | ♀ | 56 | 42 | 65 |
| 11303 | ♀ | 55 | 38 | 61 |
| 11304 | ♀ | 60 | 43 | 62 |

TABLE OF SCALE COUNTS—TAGUS COVE, ALBEMARLE ISLAND—*Cont'd*

| Number | Sex | Scale Rows | Crest | Belly | Number | Sex | Scale Rows | Crest | Belly |
|---|---|---|---|---|---|---|---|---|---|
| 11372 | ♂ | 58 | 36 | 60 | 11369 | ♀ | 60 | 43 | 62 |
| 11381 | ♂ | 59 | 38 | 61 | 11371 | ♀ | 61 | 39 | 61 |
| 11383 | ♂ | 62 | 37 | 63 | 11373 | ♀ | 57 | 37 | 65 |
| | | | | | 11374 | ♀ | 56 | 37 | 61 |
| | | | | | 11375 | ♀ | 60 | 37 | 64 |
| | | | | | 11376 | ♀ | 57 | 39 | 65 |
| | | | | | 11377 | ♀ | 60 | 37 | 65 |
| | | | | | 11378 | ♀ | 58 | 36 | 60 |
| | | | | | 11379 | ♀ | 55 | 36 | 65 |
| | | | | | 11380 | ♀ | 54 | 39 | 63 |
| | | | | | 11382 | ♀ | 54 | 37 | 61 |

TABLE OF SCALE COUNTS—COWLEY MOUNTAIN, ALBEMARLE ISLAND

| Number | Sex | Scale Rows | Crest | Belly |
|---|---|---|---|---|
| 12157 | ♂ | 60 | 41 | 65 |

TABLE OF SCALE COUNTS—IGUANA COVE, ALBEMARLE ISLAND

| Number | Sex | Scale Rows | Crest | Belly | Number | Sex | Scale Rows | Crest | Belly |
|---|---|---|---|---|---|---|---|---|---|
| 11249 | ♂ | 59 | 42 | 67 | 11251 | ♀ | 56 | 40 | 67 |
| 11250 | ♂ | 59 | 38 | 64 | 11261 | ♀ | .. | 37 | 68 |

TABLE OF SCALE COUNTS—VILAMIL, ALBEMARLE ISLAND

| Number | Sex | Scale Rows | Crest | Belly | Number | Sex | Scale Rows | Crest | Belly |
|---|---|---|---|---|---|---|---|---|---|
| 10310 | ♂ | 58 | 42 | 65 | 10308 | ♀ | 57 | 41 | 68 |
| 10313 | ♂ | 61 | 40 | 68 | 10309 | ♀ | 56 | 38 | 65 |
| 10314 | ♂ | 57 | 38 | 64 | 10311 | ♀ | 56 | 41 | 62 |
| 10315 | ♂ | 60 | 37 | 65 | 10316 | ♀ | 56 | 38 | 66 |
| 10322 | ♂ | 57 | 36 | 63 | 10317 | ♀ | 55 | 39 | 62 |
| 10324 | ♂ | 56 | 37 | 62 | 10318 | ♀ | 60 | 37 | 68 |
| 10325 | ♂ | 56 | 37 | 66 | 10319 | ♀ | 58 | 42 | 65 |
| 10326 | ♂ | 62 | 42 | 69 | 10320 | ♀ | 61 | 45 | 66 |
| 10329 | ♂ | 58 | 36 | 65 | 10321 | ♀ | 59 | 43 | 64 |
| 10344 | ♂ | 58 | 36 | 65 | 10323 | ♀ | 58 | 37 | 63 |
| 11558 | ♂ | 60 | 39 | 69 | 10327 | ♀ | 60 | 37 | 61 |
| 11559 | ♂ | 60 | 44 | 67 | 10328 | ♀ | 58 | 40 | 65 |
| 11134 | ♂ | 58 | 40 | 69 | 10330 | ♀ | 57 | 40 | 67 |
| 11136 | ♂ | 56 | 40 | 60 | 10332 | ♀ | 56 | 43 | 63 |
| 11137 | ♂ | 57 | 41 | 68 | 10333 | ♀ | 56 | 37 | 63 |
| 11138 | ♂ | 61 | 32 | 70 | 10335 | ♀ | 56 | 44 | 64 |
| 11143 | ♂ | 64 | 39 | 66 | 10336 | ♀ | 59 | 38 | 60 |
| 11148 | ♂ | 57 | 39 | 64 | 10337 | ♀ | 62 | 37 | 64 |
| 11153 | ♂ | 61 | 39 | 70 | 11133 | ♀ | 64 | 41 | .. |
| 11154 | ♂ | 60 | 41 | 65 | 11135 | ♀ | 61 | 40 | 66 |
| 11157 | ♂ | 61 | 39 | 67 | 11141 | ♀ | 62 | 44 | 64 |
| 11158 | ♂ | 60 | 36 | 67 | 11151 | ♀ | 56 | 39 | 68 |

TABLE OF SCALE COUNTS—VILAMIL, ALBEMARLE ISLAND—*Continued*

| Number | Sex | Scale Rows | Crest | Belly | Number | Sex | Scale Rows | Crest | Belly |
|---|---|---|---|---|---|---|---|---|---|
| 11160 | ♂ | 62 | 42 | 69 | 11152 | ♀ | 56 | 38 | 67 |
| 11163 | ♂ | 59 | 41 | 71 | 11162 | ♀ | 59 | 39 | 63 |
| 11167 | ♂ | 62 | 35 | 63 | 11166 | ♀ | 61 | 39 | 62 |
| 11179 | ♂ | 60 | 43 | 68 | 11169 | ♀ | 58 | 38 | 66 |
| 11183 | ♂ | 57 | 39 | 69 | 11170 | ♀ | 62 | 43 | 69 |
| 11185 | ♂ | 59 | 39 | 66 | 11171 | ♀ | 60 | 40 | 68 |
| 11186 | ♂ | 62 | 36 | 69 | 11173 | ♀ | 64 | 38 | 67 |
| 11198 | ♂ | 61 | 36 | 60 | 11175 | ♀ | 59 | 43 | 69 |
| 11202 | ♂ | 60 | 40 | 64 | 11176 | ♀ | 53 | 39 | 63 |
| 11209 | ♂ | 58 | 32 | 57 | 11177 | ♀ | 63 | .. | 69 |
| 11211 | ♂ | 59 | 36 | 65 | 11181 | ♀ | 63 | 42 | 66 |
| 11216 | ♂ | 59 | 42 | 68 | 11182 | ♀ | 60 | 41 | 63 |
| 11218 | ♂ | 57 | 36 | 66 | 11544 | ♀ | 60 | 39 | 67 |
| 11219 | ♂ | 57 | 34 | 60 | 11546 | ♀ | 57 | 40 | 66 |
| 11224 | ♂ | 55 | 37 | 65 | 11548 | ♀ | 55 | 42 | 65 |
| 11225 | ♂ | 60 | 40 | 64 | 11550 | ♀ | 58 | 40 | 64 |
| 11226 | ♂ | 59 | 39 | 65 | 11551 | ♀ | 57 | 39 | 60 |
| 11227 | ♂ | 59 | 40 | 66 | 11552 | ♀ | 57 | 40 | 70 |
| 11229 | ♂ | 62 | 37 | 67 | 11553 | ♀ | 59 | 36 | 66 |
| 11545 | ♂ | 62 | 42 | 67 | 11554 | ♀ | 60 | 42 | 69 |
| 11547 | ♂ | 57 | 43 | 70 | 11555 | ♀ | 59 | 39 | 63 |
| 11549 | ♂ | 64 | 38 | 64 | 11556 | ♀ | 57 | 39 | 60 |
| 11557 | ♂ | 62 | 39 | 66 | 11561 | ♀ | 56 | 38 | 67 |
| 11563 | ♂ | 57 | 41 | 65 | 11562 | ♀ | 56 | 40 | 64 |
| 11565 | ♂ | 62 | 41 | 71 | 11564 | ♀ | 57 | 41 | 64 |
| 11568 | ♂ | 56 | 40 | 68 | 11566 | ♀ | 60 | 38 | 68 |
| 11570 | ♂ | 59 | 42 | 66 | 11567 | ♀ | 61 | 43 | 64 |
| 11572 | ♂ | 57 | 36 | 64 | 11569 | ♀ | 59 | 37 | 67 |
| 11573 | ♂ | 60 | 40 | 67 | 11571 | ♀ | 58 | 40 | 62 |
| 11574 | ♂ | 59 | 37 | 67 | 11576 | ♀ | 57 | 40 | 67 |
| 11575 | ♂ | 57 | 39 | 63 | 11578 | ♀ | 64 | 40 | 62 |
| 11577 | ♂ | 57 | 40 | 62 | 11579 | ♀ | 63 | 41 | 62 |
| 11580 | ♂ | 56 | 41 | 63 | 11584 | ♀ | 55 | 39 | 64 |
| 11581 | ♂ | 56 | 41 | 66 | 11588 | ♀ | 55 | 41 | 63 |
| 11582 | ♂ | 58 | 42 | 62 | 11590 | ♀ | 60 | 38 | 63 |
| 11583 | ♂ | 55 | 40 | 62 | 11591 | ♀ | 56 | 39 | 67 |
| 11585 | ♂ | 56 | 39 | 61 | 11592 | ♀ | 60 | 40 | 71 |
| 11586 | ♂ | 63 | 36 | 66 | 11594 | ♀ | 58 | 41 | 68 |
| 11587 | ♂ | 60 | .. | 65 | | | | | |

TABLE OF SCALE COUNTS—NARBOROUGH ISLAND

| Number | Sex | Scale Rows | Crest | Belly | Number | Sex | Scale Rows | Crest | Belly |
|---|---|---|---|---|---|---|---|---|---|
| 11272 | ♂ | 58 | 38 | 69 | 11319 | ♀ | 60 | 40 | 63 |
| 11273 | ♂ | 61 | 38 | 67 | 11320 | ♀ | 58 | 37 | 65 |
| 11317 | ♂ | 54 | 42 | 67 | 11328 | ♀ | 55 | 37 | 63 |
| 11318 | ♂ | 56 | 41 | 71 | 11329 | ♀ | .. | 35 | 68 |
| 11321 | ♂ | 55 | 37 | 64 | 11330 | ♀ | 62 | 39 | .. |
| 11322 | ♂ | 61 | 40 | 70 | 11331 | ♀ | 58 | 35 | 66 |
| 11323 | ♂ | 58 | 38 | 72 | 11332 | ♀ | 61 | 37 | 65 |
| 11324 | ♂ | 55 | 38 | 66 | 11335 | ♀ | 54 | 41 | 67 |
| 11325 | ♂ | 54 | 41 | 68 | 11336 | ♀ | 59 | 42 | 64 |
| 11326 | ♂ | 56 | 39 | 65 | 11337 | ♀ | 57 | 40 | 65 |
| 11327 | ♂ | 60 | 43 | 76 | 11338 | ♀ | 59 | 38 | 67 |

TABLE OF SCALE COUNTS—NARBOROUGH ISLAND—*Continued*

| Number | Sex | Scale Rows | Crest | Belly | Number | Sex | Scale Rows | Crest | Belly |
|---|---|---|---|---|---|---|---|---|---|
| 11333 | ♂ | 54 | 38 | 68 | 11339 | ♀ | 57 | 36 | 63 |
| 11334 | ♂ | 58 | 38 | 66 | 11340 | ♀ | 55 | 38 | 61 |
| 11343 | ♂ | 57 | 37 | 67 | 11341 | ♀ | 58 | 42 | 67 |
| 11345 | ♂ | 64 | 39 | 65 | 11342 | ♀ | 60 | 42 | 64 |
| 11346 | ♂ | 61 | 38 | 70 | 11344 | ♀ | 56 | 39 | 67 |
| 11349 | ♂ | 60 | 37 | 69 | 11347 | ♀ | 54 | 36 | 61 |
| 11350 | ♂ | 55 | 35 | 62 | 11348 | ♀ | 55 | 40 | 67 |
| 11352 | ♂ | 55 | 36 | 64 | 11351 | ♀ | 58 | 41 | 72 |
| 11353 | ♂ | 53 | 35 | 65 | 11430 | ♀ | 55 | 36 | 62 |
| 11452 | ♂ | 58 | 39 | 63 | 11431 | ♀ | 55 | 36 | 61 |
| 11453 | ♂ | 59 | 37 | 66 | 11433 | ♀ | 57 | 37 | 63 |
| 11454 | ♂ | 56 | 37 | 63 | 11434 | ♀ | 55 | 39 | 64 |
| 11455 | ♂ | 59 | 37 | 65 | 11435 | ♀ | 58 | 35 | 62 |
| 11456 | ♂ | 55 | 31 | 60 | 11436 | ♀ | 60 | 37 | 66 |
| 11457 | ♂ | 54 | 35 | 62 | 11437 | ♀ | 59 | 37 | 68 |
| 11458 | ♂ | 62 | 35 | 67 | 11438 | ♀ | 57 | 39 | 65 |
| 11459 | ♂ | 58 | 36 | 62 | 11440 | ♀ | 60 | 35 | 64 |
| 11463 | ♂ | 59 | 42 | 67 | 11442 | ♀ | 55 | 40 | 63 |
| 11464 | ♂ | 58 | 39 | 69 | 11444 | ♀ | 56 | 34 | 67 |
| 11465 | ♂ | 58 | 38 | 68 | 11446 | ♀ | 55 | 36 | 61 |
| 11469 | ♂ | 54 | 36 | 67 | 11447 | ♀ | 59 | 36 | 64 |
| 11470 | ♂ | 61 | 40 | 71 | 11448 | ♀ | 55 | 36 | 62 |
| 11471 | ♂ | 57 | 42 | 62 | 11449 | ♀ | 54 | 38 | 63 |
| 11475 | ♂ | .. | .. | 63 | 11450 | ♀ | 57 | 37 | 66 |
| 11477 | ♂ | 57 | 41 | 65 | 11451 | ♀ | 55 | 38 | 63 |
| 11478 | ♂ | 58 | 39 | 68 | 11460 | ♀ | 58 | 37 | 68 |
| 11483 | ♂ | 58 | 36 | 67 | 11461 | ♀ | 55 | 40 | 69 |
| 11484 | ♂ | 55 | 32 | 60 | 11462 | ♀ | 60 | 39 | 66 |
| 11485 | ♂ | 55 | 39 | 65 | 31466 | ♀ | 62 | 39 | 71 |
| 11486 | ♂ | 59 | 39 | 70 | 11467 | ♀ | 55 | 37 | 66 |
| | | | | | 11468 | ♀ | 55 | 40 | 66 |
| | | | | | 11472 | ♀ | 58 | 35 | 65 |
| | | | | | 11473 | ♀ | 54 | 38 | 67 |
| | | | | | 11474 | ♀ | 56 | 35 | 61 |
| | | | | | 11476 | ♀ | 60 | 39 | 61 |
| | | | | | 11479 | ♀ | 59 | 35 | 65 |
| | | | | | 11480 | ♀ | 60 | 40 | 66 |
| | | | | | 11481 | ♀ | 55 | 39 | 63 |
| | | | | | 11482 | ♀ | 55 | 36 | 62 |
| | | | | | 11487 | ♀ | 58 | 36 | 62 |

*Habits.*—The eggs vary from four to six in number. They are white and elliptical with leathery shells. Females were seen on various islands, in May and June, digging short oblique burrows in the sand.

Stomachs of specimens from Indefatigable Island contained insects and spiders; those from the Seymours, insects, seed-cases, and berries; those from James contained spiders, insects and seeds. On Narborough they are said to feed on crustaceans near the shore, while farther inland insects and the seed capsules and ovaries of various flowers are eaten.

Dec. 27, 1905.—Went ashore at James Bay to collect lizards. Worked in the country back of the lagoon. I found the lizards common though the brush and on the lava blocks. Several were about six or seven feet up in the trees, probably looking for insects to eat, and some were feeding on the green leaves which are just sprouting. They were fairly tame, the females being more active than the males.

July 28, 1906.—Followed up a valley toward Bartholomew Island. Lizards are scarce inland, but common near the beach. The mate reports them abundant on Bartholomew Island.

Aug. 8, 1906, James Bay.—Found the lizards somewhat rarer than on our former visit. I examined the stomachs of two females and found that they contained small fragments of beetle wings. Hunter reports seeing lizards on the top of the mountain, but they are somewhat scarce there.

Nov. 23, 1905.—Sailed for Daphne Island in the morning. There are two islands: one a mere rock which it is impossible to land on, the other a crater of a volcano. We landed on the crater, and worked up to the top. I saw few lizards on the outer slope, but they were common on the bottom of the crater, which is a bed of white sand with a few scattered cactus plants. Many of the *Tropiduri* kept in the shelter of the cactus for protection from the hawks, which we saw sailing over the island. Others were caught under lava blocks whither they ran when frightened.

Narborough Island.—Lizards are common, but seem smaller than those on the south side of the island. They are more abundant near the coast. The females are wilder than the males. The dark bodies of the lizards show distinctly against the red lava.

August 22, 1906, Vilamil, Albemarle Island.—Went up with our outfit to the hacienda to start up the mountain. The weather at this elevation (1300 feet) is constantly rainy and foggy, and the prospect of camping is not very pleasant. There is nothing visible in the way of reptiles. *Tropiduri* do not seem to go much higher than 200 or 300 feet—the beginning of the green zone. The country seems very wet for them, just as Chatham Island does, and I did not see any as far up as the crater, although they occur in the crater itself.

The grassy area commences at about 1500 feet and extends to the rim of the crater at 3150 feet.

*General remarks.*—While the lizards of these islands are so similar that we have been able to find no characters which will serve to distinguish them, they nevertheless are not absolutely identical. The Indefatigable Island lizards have scales somewhat larger than those of the James Island specimens. A similar average difference probably exists between the lizards of Narborough and Albemarle. As may be seen when the counts of the scales about the body are plotted, the curves for the various islands do not coincide, although their bases overlap. It thus becomes evident that differentiation has begun on these islands also, although it still is too intangible to be recognized in momenclature.

### Conolophus subcristatus (Gray)

Land Iguana

*Trachycephalus subcristatus* Gray, Cat., p. 188.
*Amblyrhynchus subcristatus* Gray, Zool. Misc., 1831, p. 6, and Zool. Beechy's Voyage, Rept., p. 93; Darwin, Journ. Beagle, p. 469.
*Amblyrhynchus demarlii* Dum & Bibr., IV, p. 197; Bell, Zool. Beagle, Rept., p. 22, pl. XII.
*Hypsilophus* (*Conolophus*) *demarlii* Fitzinger, Syst. Rept., 1843, p. 55.
*Conolophus subcristatus* Steindachner, Festschr. Zool.-Bot. Ges. Wien, 1876, p. 322, pls. IV-VII; Gunther, Proc. Zool. Soc., 1877, p. 67; Boul., Cat. Lizards, II, p. 187, 1885; Garman, Bull, Essex Inst., XXIV, 1892, p. 5 (part); Heller, Proc. Wash. Acad. Sci., V, 1903, p. 85.
*Conolophus subcristatus pictus* Roth & Hart, Novit. Zool., VI, 1899, p. 102.

*Diagnosis.*—Rostral once and a half times as broad as high; dorsal crest not so high as in *C. pallidus;* snout less pointed; coloration above, yellow on head, neck and fore limbs; red, brown, or olive on back, hind limbs, and tail.

*Distribution.*—The land iguana was formerly abundant on James, Indefatigable, South Seymour, Albemarle, and Narborough islands. It now is very rare on Albemarle, and probably extinct on James and Indefatigable.

*Material.*—A few bones were collected on James. Sixteen or eighteen specimens were secured on South Seymour, two at Tagus Cove, Albemarle, and twenty-one on Narborough.

There seem to be no constant differences between the specimens at hand from these islands. The Narborough iguanas have red backs, while the South Seymour ones usually have

this region dark olive; but a few from Seymour are colored like those from Narborough.

*Variation.*—The supralabials are 9 to 13 (Seymour 9–13, Narborough 9–13, Albemarle 11), the usual number being eleven. The femoral pores are 20 to 27 (Seymour 20–24, Narborough 20-27, Albemarle 21-22). The rostral is twice as broad as high in thirty-one per cent of the specimens from Seymour, seventy-five per cent of those from Narborough, and fifty per cent of those from Albemarle; being less than twice in all the other specimens. The large spines of the crest usually begin nearer the skull in Seymour specimens than in those from Narborough.

*Field Notes.*—South Seymour Island, Nov. 21, 1905.—Land iguanas are common, and are scattered all about, not living in colonies like those on Barrington Island. There are a few burrows, but most of the iguanas live in the broken lava. Some are red like the lava, and others are dark olive above. The under surfaces of body and legs are yellow, and the head is light yellow. The males here are very large. I saw one large male eating on a cactus, and our mate, Mr. Nelson, said that one came and drank the blood of a goat he had shot. July 26, 1906.—Found iguanas common, the males predominating. They have taken on a blackish color now, and are not so brilliant as on our former visit. Several stomachs examined were found to contain cactus and the leaves of a shrub *(Maytenus)* which resembles a scrub oak.

Indefatigable Island, Oct. 25, 1905.—Just back of the beach, on the side of the island near Barrington, we found the deserted burrows of what must at one time have been a large colony of land iguanas. The species seems now to be extinct on this island.

James Island, July 28, 1906.—No iguanas were seen, but I found some bones in a crack in the lava on the coast opposite Bartholomew Island.

Tagus Cove, Albemarle Island, March 23, 1906.—Beck reports seeing about six land iguanas, of which he secured one. They are extremely wild. He noticed one very large brightly colored male. The one taken was a female in the act of shedding its skin. March 24, 1906.—I saw only one iguana today. They are very rare; probably only six or eight are

left in the colony. Judging from the number of burrows one may safely say there were at one time as many as a thousand in this colony. The survivors keep well in the brush, and when once they start running do not stop until they get into a burrow. Mr. Beck found a few more iguanas at the end of a valley running along the foothills. April 7, 1906.—King and I secured an iguana near the foot of the mountain opposite Tagus Cove. He evidently was a stray one, as no other signs of them were seen so far to the north. They do not, however, any longer live in colonies. The one secured was a male. He allowed us to approach fairly near, but went fast when we chased him, and finally was caught in a hole in the lava. He was shedding his skin.

Bank's Bay, Albemarle Island, April 9, 1906.—Large numbers of deserted iguana burrows were seen all over the level country.

Narborough Island, April 6, 1906.—Land iguanas are common. They are brightly colored yellow and red. They live in cracks in the lava. No colonies of burrows were observed. April 17, 1906.—We made a landing on a slope of cinders and lava, over which we climbed to the top and reached a plateau with some vegetation and a little soil, the country being mostly broken lava of a reddish color. This plateau extended about two and a half miles to the base of the mountain. Here we found iguanas scattered over the lava. They were wild and had to be shot. All were of a uniform color, males and females, brick reddish body and tail, head bright yellow, and lower surfaces light-yellow. A few burrows were seen, but most of the iguanas here live in holes in the lava. The stomachs of those examined all contained *Scalesia,* a plant growing some two feet high, and scattered abundantly over the surrounding country. The females taken had no enlarged ovaries, and their breeding season is possibly over. Males and females were about equally common.

### **Conolophus pallidus** Heller

Barrington Island Land Iguana

*Conolophus subcristatus,* Garman, Bull. Essex Inst., XXIV, 1892, p. 77 (part).

*Conolophus pallidus,* Heller, Pros. Wash. Acad. Sci., V, 1903, p. 87.

*Diagnosis.*—Rostral not less than twice as broad as high; dorsal crest higher than in *C. subcristatus;* snout more pointed; coloration above clay yellow.

*Type.*—Adult female, Stanford University No. 4749. **Barrington Island, Galapagos Archipelago,** May 1899.

*Distribution.*—Barrington Island.

*Material.*—The Academy collection includes twenty-five adult specimens in alcohol, and some skins and bones.

*Variation.*—The supralabials range from 9 to 11, the usual number being eleven. The femoral pores vary from 19 to 25, the most frequent numbers being 21 and 22. The rostral is not less than twice as broad as high in any specimen. The coloration is constantly of the light yellowish type.

*Field Notes.*—Oct. 20, 1905.—Anchored on N. E. coast of Barrington, and went ashore and a mile inland to the iguana colony on a plateau at an elevation of about three hundred feet. The ground is composed of soft red volcanic dust which is easily dug by the iguanas. The burrows resemble those of a ground-squirrel only larger. We found the iguanas common here. As a rule they were sitting at the mouths of their burrows, and would run in on near approach. They were awkward in their movements but covered ground at good speed. They lose their heads when chased by several persons, and don't make for their burrows, but run around and get caught in the brush, where they are easily captured by their tails. They are very vicious, seizing one another by the jaws and drawing blood. One we caught tore the whole lower jaw off another. They are bright buff to orange in coloration, the eyes being bright red with round black pupil.

Oct. 23, 1905. Found three or four females containing large eggs. The stomachs contained cactus, which grows abundantly all over the island.

Oct. 24, 1905. Found the males rare, not living in the colony, but outside in the lava piles. I think I have three males altogether.

July 9, 1906. We found that some of the natives had visited the island and cleaned out the entire iguana colony where we secured our specimens on our first visit. However, we saw a few iguanas scattered about.

July 10, 1906. King and I visited the valleys on the north coast. We saw numbers of iguanas scattered all about, but none in colonies. They are still plentiful on this island, despite the visits of the natives, who kill them for food.

We did not see any young specimens. Ten eggs were taken from one female and seven from another. They are large, with white, leathery shells. The ten measure 51×77, 53×77, 54×75, 54×77, 54×79, 54×79, 54×80, 54×82, 56×77, and 57×77 mm. Some of the other set measure 50×74, 51×75, 51×78, 52×78, and 53×73 mm.

### **Amblyrhynchus cristatus** Bell

Sea Iguana

*Amblyrhynchus cristatus Bell, Zoöl.* Journ., II, 1825, p. 206, Supl., pl. XII, and Zoöl. Beagle Rept., p. 23; Dum & Bibr., IV, 1837, p. 195; Darwin, Jour. Beagle, p. 466; A. Dum., Cat. Meth., Rept., p. 62; Steindachner, Festschr., Zool-Bot. Ges. Wien, 1876, p. 316, pls. III, V, VI, VII; Günther, Proc. Zool. Soc., 1877, p. 67; Boulenger, Cat. Lizards, II, p. 185; Cope, Proc. U. S. Nat. Mus., XII, 1889, p. 147; Garman, Bull. Essex Inst., XXIV, 1892, p. 79 (part); Heller, Proc. Wash. Acad. Sci., V, 1903, p. 89.

*Oreocephalus cristatus* Gray, Cat., p. 189, 1845.

*Iguana* (*Amblyrhynchus*) *cristatus* Gray, Griff. A. K., IX, Syn., p. 37.

*Iguana* (*Amblyrhynchus*) *ater* Gray, Griff. A. K., IX, Syn., p. 37.

*Amblyrhynchus ater* Dum & Bibr., p. 196.

*Hypsilophus* (*Amblyrhynchus*) *cristatus* Fitzinger, Syst. Rept., 1843, p. 55.

*Hypsilophus* (*Amblyrhynchus*) *ater* Fitzinger, Syst. Rept., 1843, p. 55.

*Amblyrhynchus cristatus* var. *ater.* Garman, Bull. Essex Inst., XXIV, 1892, p. 8.

*Amblyrhynchus cristatus* var. *nanus* Garman, Bull. Essex Inst., XXIV, 1892, p. 80.

*Distribution.*—This species is restricted to the Galapagos Archipelago, where it has been collected at, or reported from, the following islands: Culpepper, Wenman, Abingdon, Bindloe, Tower, Chatham, Hood, Gardner-near-Hood, Charles, Champion, Enderby, Barrington, Indefatigable, South Seymour, Daphne, James, Jervis, Duncan, Brattle, Narborough, and on Albemarle at Bank's Bay, Tagus Cove, and Iguana Cove.

*Material.*—The present collection includes some one hundred and eighty specimens, from Culpepper, Wenman, Abingdon, Bindloe, Tower, Chatham, Hood, Champion, Indefatigable, James, Jervis, Brattle, Narborough islands, and Iguana and Tagus coves on Albemarle Island.

*General remarks.*—Careful comparison of the considerable number of specimens at hand has revealed no constant differ-

ences between those from the various islands. The sea iguanas of Tower and of Duncan islands have been given separate names by some authors, but we are unable to regard them as distinct. Even the iguanas of widely separated islands, such as Culpepper and Hood, seem not to differ upon direct comparison.

*Variation.*—The femoral pores vary from twenty to thirty-one. In all (7) specimens from Culpepper Island the mental separates the infralabials. This same conditions is found in three out of seven from Wenman Island, in twenty-seven out of forty-four from Hood Island, in twenty-three out of twenty-seven from Bindloe Island, in six out of eight from Albemarle Island, in all (6) from Indefatigable Island, in four out of five from Jervis Island, in twenty-nine out of thirty-eight from Abingdon Island, in five out of six from Brattle Island, in one from Champion Island, two from James Island, one from Chatham Island, and four from Narborough Island.

*Field notes.*—Hood Island, Feb. 5, 1906. The iguanas now are very brightly colored—green, red, and black. They are common on the coast, and are seen lying close to the water, their long claws enabling them to hang on to the rocks in spite of the strong wash of heavy surf which breaks over them. I saw none swimming or feeding today, in fact one seldom sees them in the water. They lie in the sun on the rocks, and never make for the water when pursued, but run along the rocks and get into crevices.

Gardner-near-Hood, Oct. 1, 1905. Found sea iguanas common on Gardner. At low tide, they feed on the green seaweed which covers the rocks, while at high tide they take to the higher places and lie in the sun.

Charles Island. No sea iguanas were seen by any of the party.

Chatham Island, Feb. 16, 1906. Sea iguanas are very rare on this island, where the natives formerly ate them and even their eggs. Ochsner reports seeing about three in the vicinity of Finger Point, and King secured one.

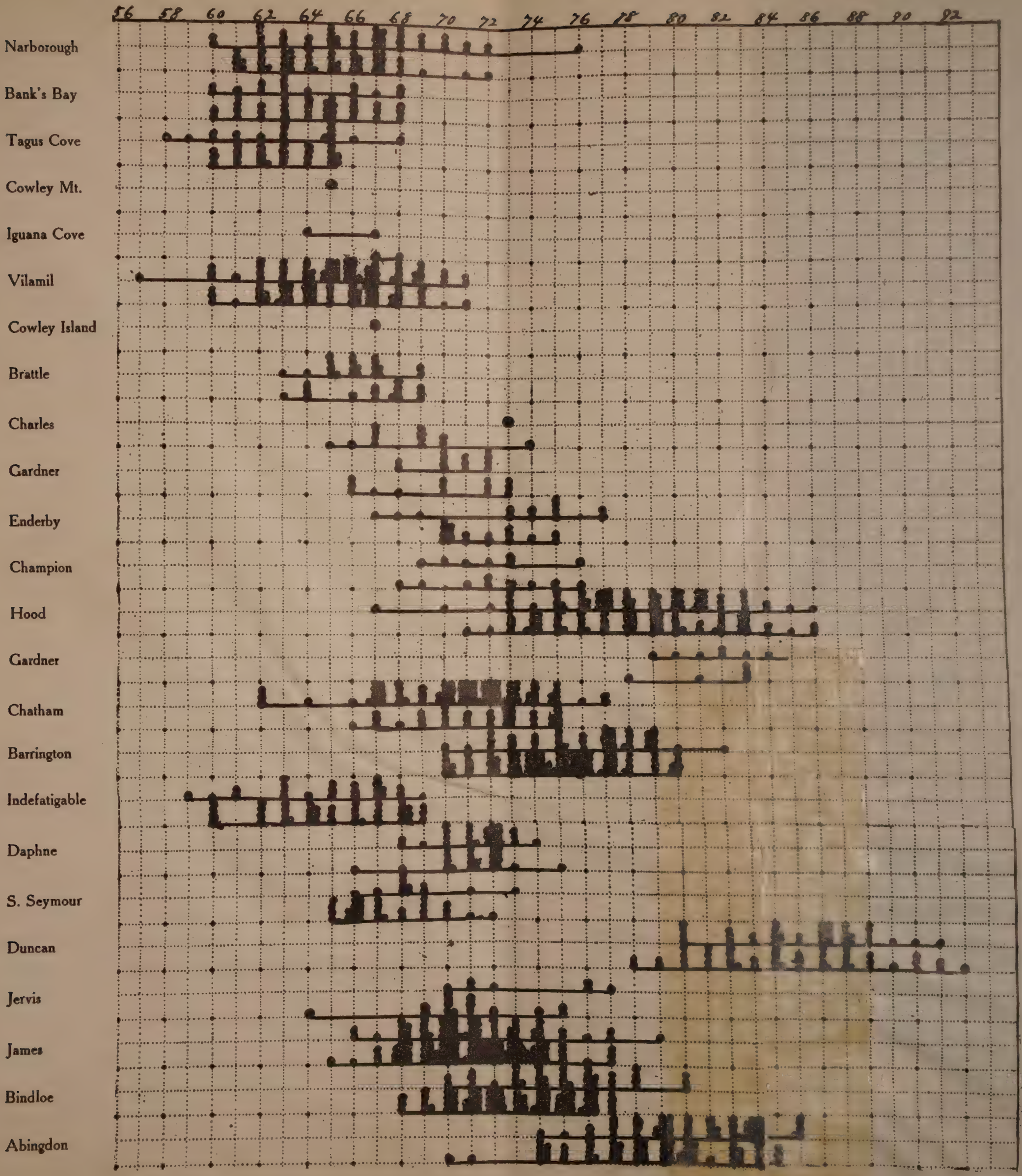
Barrington Island, Oct. 23, 1905. I saw only two sea iguanas, and tried to catch one but failed. The other was on a small rock a few hundred yards off the main island.

Tagus Cove, Albemarle Island, April 5, 1906. Sea iguanas are common on the rocks, and can be seen feeding on the seaweed at low tide. They eat with the sides of their mouths, much as a dog would chew a bone.

Bank's Bay, Albemarle Island, April 9, 1906. Sea iguanas were abundant along the rocks. I saw none brightly colored like those on Hood Island. None of the females had enlarged ovaries, so the breeding season probably is over. I saw a great many nests in the sand. These were little hollows about a foot in diameter and six inches deep, sloping to a point at the bottom. I could find no eggs. I saw iguanas here in the water more than at any other place. They swim like our water-dogs, (*Diemictylus*) with the legs carried close to the body, and propelling themselves by sinuous movements of the body and tail. The head and crest to the middle of the body can be seen above the water.

## EXPLANATION OF PLATE VIII

Chart of the counts of scales around the middle of the body in *Tropidurus*. Each dot represents the count on one specimen. In the counts from each island, or locality, the males are represented on the upper line, the females on the lower line. The crosses represent the extreme counts given by previous authors.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Cowley Mt.
Iguana Cove
Vilamil
Cowley Island
Brattle
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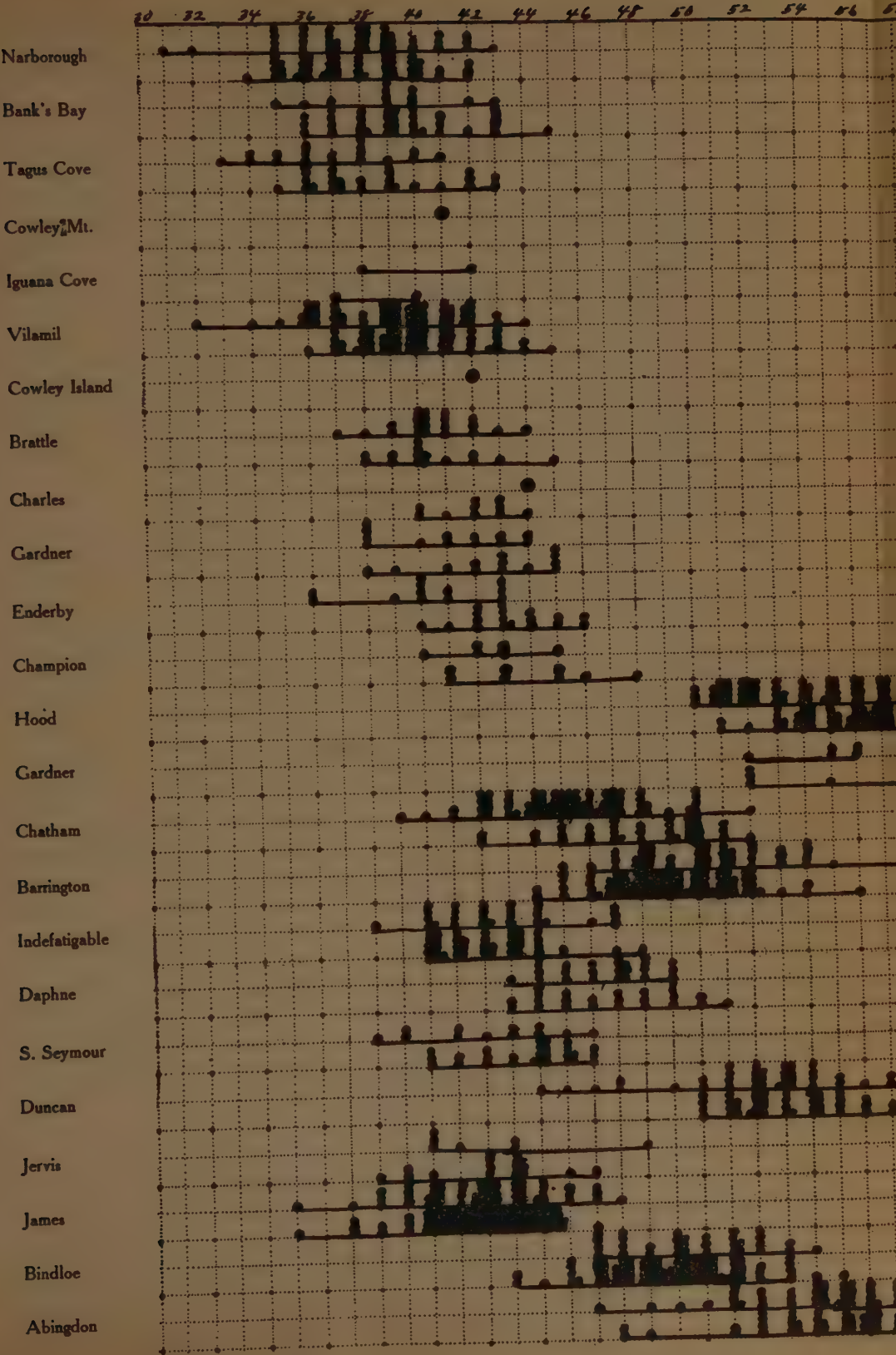
Gardner
Enderby
Champion
Hood
Gardner
Chatham
Barrington
Indefatigable
Daphne
S. Seymour
Duncan
Jervis
James
Bindloe
Abingdon

## EXPLANATION OF PLATE IX

Chart of the counts of scales in the crest in *Tropidurus*. Each dot represents the count on one specimen. In the counts from each island, or locality, the males are represented on the upper line, the females on the lower.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Iguana Cove
Vilamil
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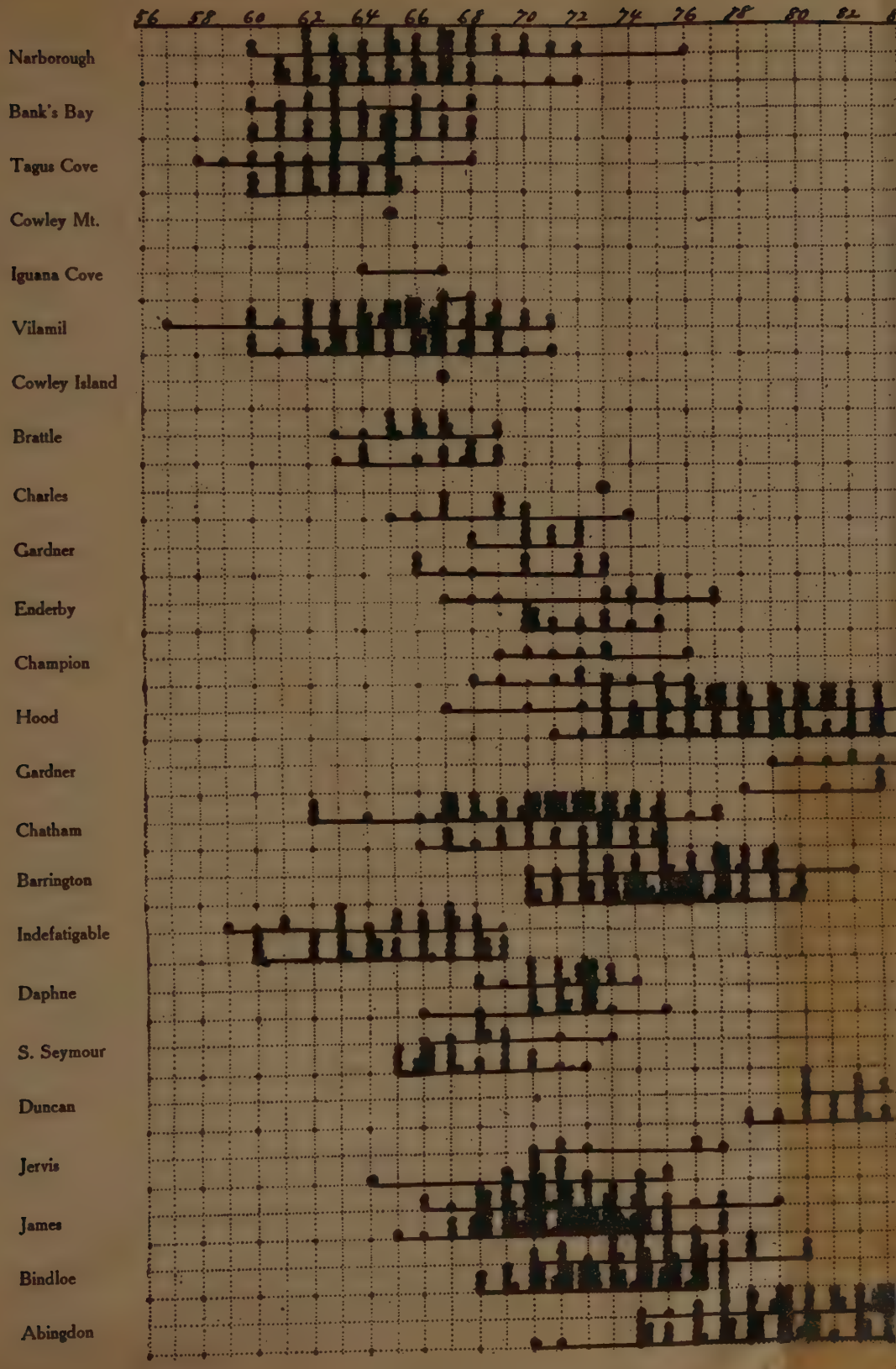
Champion
Hood
Gardner
Chatham
Barrington
Indefatigable
Daphne
S. Seymour
Duncan
Jervis
James
Bindloe
Abingdon

## EXPLANATION OF PLATE X.

Chart of the counts of scales along the belly in *Tropidurus*. Each dot represents the count on one specimen. In the counts from each island, or locality, the males are represented on the upper line, the females on the lower.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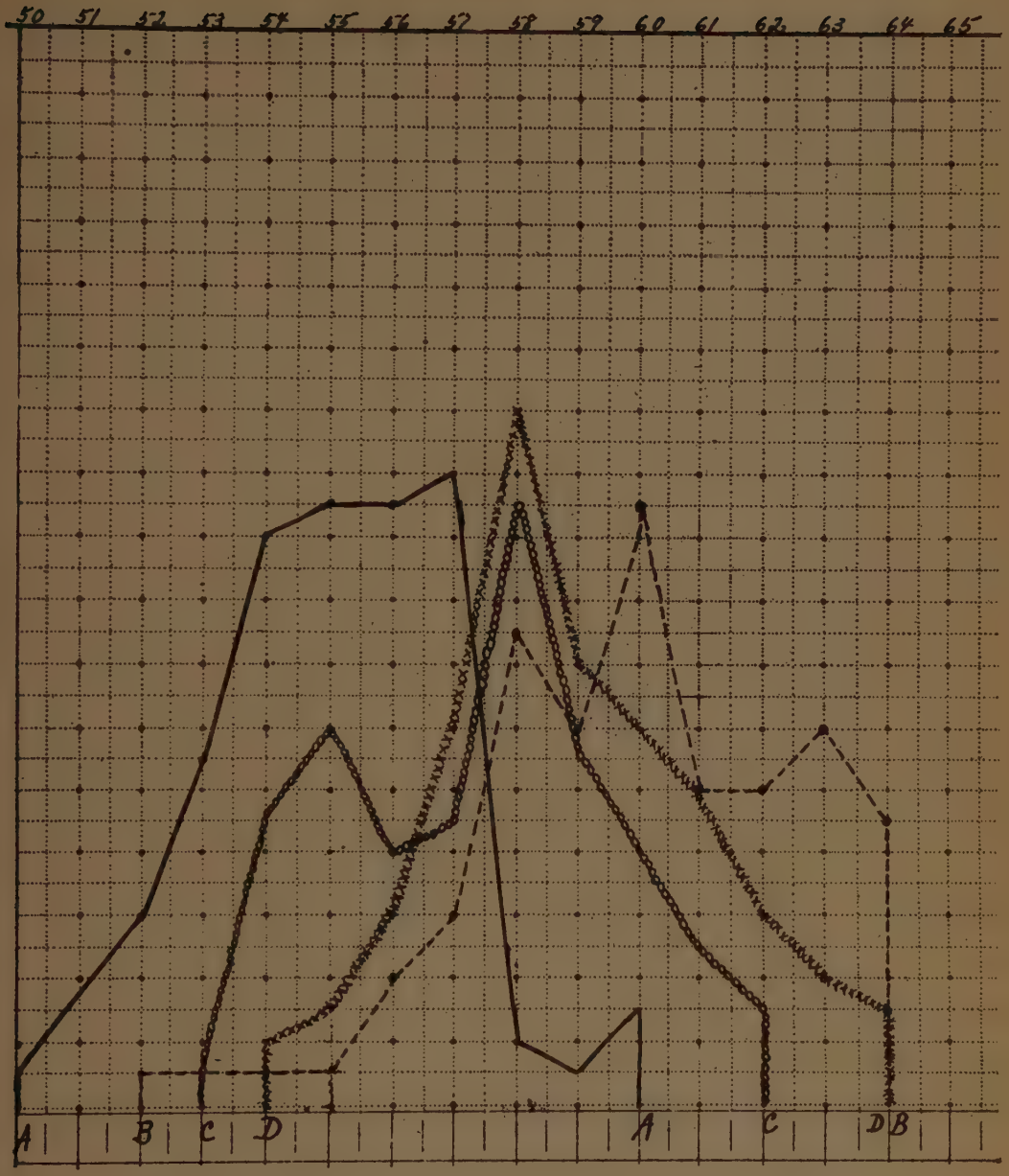
Enderby
Champion
Hood
Gardner
Chatham
Barrington
Indefatigable
Daphne
S. Seymour
Duncan
Jervis
James
Bindloe
Abingdon

## EXPLANATION OF PLATE XI

Chart of counts of scales around the middle of the body in one hundred specimens each from:

A.—Indefatigable and South Seymour islands.
B.—James Island.
C.—Narborough Island.
D.—Albemarle Island.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C
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# Expedition of the California Academy of Sciences to the Galapagos Islands, 1905-1906

## X

## The Gigantic Land Tortoises of the Galapagos Archipelago

BY

JOHN VAN DENBURGH

*Curator of the Department of Herpetology*

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## X

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BY JOHN VAN DENBURGH

*Curator of the Department of Herpetology*

CONTENTS

PAGE

INTRODUCTION ..... 206
GIGANTIC LAND TORTOISES, FOSSIL AND RECENT ..... 206
Indian Ocean Races ..... 206
Galapagoan Races ..... 209
Early History ..... 209
First Discovery, 1535 ..... 209
Cowley, 1684 ..... 210
Dampier, 1684 ..... 210
Rogers, 1708 ..... 211
Clipperton, 1720 ..... 211
Colnett, 1793 ..... 212
Delano, 1800 ..... 212
Porter, 1813 ..... 215
Hall, 1822 ..... 219
Morrell, 1823 ..... 219
First Settlement, 1832 ..... 219
Downes, 1833 ..... 220

September 30, 1914.

Later Visits ..... 220
Darwin, 1835 ..... 220
"Venus," 1838 ..... 226
"Herald," 1846 ..... 226
"Eugenie," 1852 ..... 226
Dr. Habel, 1868 ..... 226
Hassler, 1872 ..... 226
Cookson, 1875 ..... 226
"Challenger," 1875 ..... 228
"Albatross," 1888 and 1891 ..... 228
Baur and Adams, 1891 ..... 228
Webster-Harris, 1897 ..... 228
Snodgrass and Heller, 1898-1899 ..... 234
Captain Noyes, 1900 ..... 237
Beck, 1901 and 1902 ..... 237
Academy Expedition, 1905-1906 ..... 241
Present Status ..... 243
Number of Races ..... 243
Living ..... 243
Extinct ..... 243
Systematic Account ..... 244
1. Nomenclature ..... 244
Names proposed ..... 244
Discussion of names ..... 244
*Testudo nigra* ..... 244
*californiana* ..... 245
*elephantopus* ..... 245
*nigrita* ..... 249
*planiceps* ..... 251
*ephippium* ..... 251
*microphyes* ..... 252
*vicina* ..... 253
*galapagoensis* ..... 255
*güntheri* ..... 256
*wallacei* ..... 257
Application of names ..... 259
2. Description ..... 259
Characters available for classification ..... 259
The shell ..... 259
Variation in plates ..... 260
Variation in shape ..... 289
Measurements used ..... 289
Charts of each measurement ..... 289
Table of averages ..... 289
extremes ..... 289
Differences with age ..... 289
sex ..... 289
distribution ..... 290

The head, neck and limbs ..... 291
Variation in proportions ..... 291
color ..... 291
Osteological ..... 292
Key to the Galapagoan Races ..... 293
Description of each Race ..... 295
The Saddle-backed Races ..... 295
1. *Testudo abingdoni;* Abingdon ..... 295
2. *phantastica;* Narborough ..... 299
3. *becki;* North Albemarle ..... 302
4. *ephippium;* Duncan ..... 305
5. *hoodensis;* Hood ..... 312
6. *elephantopus;* Charles ..... 316
The Intermediate Races ..... 319
7. *Testudo darwini;* James ..... 319
8. *chathamensis;* Chatham ..... 323
9. *microphyes;* Albemarle ..... 329
10. *güntheri;* S. E. Albemarle ..... 335
11. *vicina;* South Albemarle ..... 344
12. *wallacei;* Jervis ..... 351
The Dome-shaped Races ..... 354
13. *Testudo porteri;* Indefatigable ..... 354
14. species ?; Cowley Mountain, Albemarle 362
The Unknown Race ..... 365
15. *Testudo species ?;* Barrington ..... 365
General Conclusions ..... 366
Bibliography ..... 369

## INTRODUCTION.

The gigantic land tortoises do not differ essentially, in any other respect than in size, from the numerous small species of the genus *Testudo* which exist in Europe, Asia, Africa, and the Western Hemisphere. They are typical chelonians, modified, as are the other members of the genus, for a purely terrestrial life, but differing from the ordinary type in their gigantic proportions. Even in size, however, there is no very sharp line of division between the smallest adults of some "gigantic" races and the largest individuals of certain species that are not so designated.

The geological history of the gigantic tortoises is still but fragmentary. We know that in the Tertiary period they were far more widely distributed than during historic times. Their remains appear as early as the Eocene, but become more numerous in Miocene and Pliocene formations. They have been found in Nebraska and Wyoming, in France, Germany, Malta, on the Lebanon, in the Sivalik Hills in India, and perhaps also in Brazil. It thus appears that these huge tortoises were formerly widely distributed over the earth; but it yet remains to be shown whether these giant races are closely related one to another, or have been independently developed from smaller species in situations where climate and food and the absence of enemies were most favorable to their growth.

In recent and historic times gigantic land tortoises have existed only in certain isolated groups of islands in the Indian and Pacific oceans, where the early explorers found them in almost incredible numbers. The rapidity with which they have disappeared from these islands upon the advent of man, and even upon the advent of the smaller predatory mammals, sufficiently explains their earlier extinction upon all the continents where they formerly occurred.

Although this paper will be immediately concerned only with the tortoises native to the Galapagos Archipelago, in the eastern Pacific, it will be well to review the history and distribution of the tortoises of the islands of the Indian Ocean. I therefore quote a few paragraphs from Dr. Günther's excellent presidential address to the Linnean Society (1898).

"The historical evidence of their existence in Madagascar is extremely scanty and vague. They had been cleared off from the inhabited parts of the island at the time when the first Europeans landed. If any of them had existed near the districts occupied by the French settlers of the seventeenth century, they would have been mentioned in some of the reports on the natural productions of the country which these people sent home. But their osseous remains, some in very perfect condition and of comparatively recent appearance, show that these animals were at one time widely spread over the island; they are often found associated with bones of *Æpyornithes, Hippopotamus,* cattle, and belong to two or three species. Their extermination probably began with the arrival of man in Madagascar; and it is highly improbable, though by no means impossible, that some individuals have survived and still linger in the vast tracts of country which are still unexplored.

"Very different were the conditions of life in the islands which are scattered over the ocean in a semi-circle round the north of Madagascar. With the exception of the Comoro group, none of these islands were inhabited by man or large mammals. Consequently the tortoises lived there in absolute security for ages, and multiplied to a degree which excited the admiration of all the early European visitors. They occupied in incredible numbers not only the larger islands of the Aldabra group, the Seychelles, Reunion, Mauritius, Rodriguez, but also the small ones with an area of a few square miles only, and with their highest points raised scarcely 100 feet above the level of the water, provided that the coral soil produced a sufficient amount of vegetation to supply them with food and shelter from the sun. Of this we have not only the testimony of trustworthy voyagers of the last two centuries, but the direct evidence of remains which accident now and then brings to the surface. A short time ago I received from my friend, Dr. Bruce, a resident at Mahe, to whom many a naturalist is indebted for assistance and hospitality, the well-preserved eggshells of a gigantic land tortoise, imbedded in a conglomerated mass of coral-sand. They came from a small island of the Amirante group, on which Dr. Bruce formed a plantation of Cocoanut-palms, and on which no tortoise had ever been known

to live. In order to secure the moisture requisite for germination and the growth of the seedling, it was necessary to plant the nuts in pits dug through loose sand to a depth of about three feet, and then through a crust of solidified coral-sand of one foot thickness. It was below this crust that the eggs were found, showing that probably centuries had elapsed since the eggs were deposited, and indicating at the same time that we shall have to go below the surface, if we want to become acquainted with the extinct autochthont races of these islands.

"The sad history of the extermination of the Mascarene tortoises is so well known that I may dispense with a repetition of its details. I will only allude to some facts with which I have become recently acquainted. The tortoises, as you know, have proved excellent and more wholesome food than the turtles. Therefore every passing ship stowed away for her long voyage as many as she could carry. With the increase of the population of the settlements, augmented by military and naval forces, the indigenous supply was rapidly exhausted; it was then supplemented by importation from other islands; and we can form an idea of the extent to which this inter-insular transport was carried from official reports to the French Indian Company. In 1759 four small vessels were especially appointed for the service of bringing tortoises from Rodriguez to Mauritius; one vessel carried a cargo of 6000; and altogether more than 30,000 were imported into Mauritius within the space of eighteen months.

"The result of this prodigality was that, at the beginning of our century, the tortoises had been pretty well swept off the whole of the islands in the Indian Ocean, so that at the present time only one spot remains where they have survived in a wild state, viz., the south island of the Aldabran atoll. Although only 18 miles long and about one mile wide, it offers by its rugged, deeply fissured surface, which is overgrown with impenetrable bush, a safe retreat to the small number of the survivors. Aldabra has never been inhabited, and only within recent years a station has been established on it for a few men who are engaged in industrial pursuits for the lessee, who rents the island from the Mauritian Government."

Turning now to the islands of the Pacific Ocean we find evidence of the natural existence of land tortoises only in the Galapagos Archipelago.

The Galapagos Islands form a fairly compact group lying under the equator, some five or six hundred miles west of the coast of Ecuador. There are some twenty-four named islands, and numerous islets and rocks. The principal islands are Albemarle, Indefatigable, Narborough, James, Chatham, Charles, Hood, Bindloe, Abingdon, Barrington, Duncan, Tower and Jervis. All are volcanic. There are said to be at least two thousand craters, some of which, on the larger islands, are of immense size, rising to a height of from three to four thousand feet. A terrific eruption occurred on Narborough in 1825, but no great volcanic activity has been reported in any of the craters since 1835.

"Considering that these islands are placed directly under the equator, the climate is far from being excessively hot; this seems chiefly caused by the singularly low temperature of the surrounding water brought here by the great southern polar current. Excepting during one short season, very little rain falls, and even then it is irregular; but the clouds generally hang low. Hence, while the lower parts of the islands are very sterile, the upper parts, at a height of a thousand feet and upward, possess a damp climate and a tolerably luxuriant vegetation. This is especially the case on the windward sides of the islands, which first receive and condense the moisture from the atmosphere."

There is some uncertainty as to who first discovered the Galapagos Islands. Some historians think it possible that they may have been visited by the Inca, Tupac Yupangi, grandfather of the Inca, Atahualpa, whom Pizarro put to death. But however this may have been, there were no signs of human habitation when the islands were discovered by Europeans in the sixteenth century. The credit for this discovery, which is said to have occurred on the 10th of March, 1535, has been given to the Spaniard, Fray Tomas de Berlanga. The early Spanish visitors found these islands occupied by tortoises in such numbers that they applied to the group the Spanish term for these creatures,—Galapagos.

During the latter part of the seventeenth, the eighteenth, and the earlier part of the nineteenth centuries, the Galapagos Islands were visited at more or less frequent intervals by buccaneers, whalers, adventurers, war-vessels, and others, in search, often, of water and a supply of tortoises for food. To these visits are due the earlier accounts of the tortoises of these islands, as well as the specimens which, finding their way into museums, have served as a basis for the original descriptions of many species. It is difficult for us in these days of rapid travel, when vessels are supplied with an endless variety of canned foods, to appreciate the interest which the early navigators, on their long, slow voyages, had in these animals, which were easy of capture, could be stowed in numbers in the hold of a vessel, kept for months without food, and were used as needed to furnish an abundance of fresh meat. When we are told that single vessels took on board at one time three or four hundred tortoises, we cannot wonder that the number remaining on the islands was rapidly reduced.

It was especially toward the end of the seventeenth century that the Galapagos Islands were visted by buccaneers. Their accounts have been quoted by Baur and Günther. Cowley, Wafer, and Dampier have given accounts of these visits, and Cowley published a map of the islands. The first visit, by Cowley, Cooke, Dampier, and Edward Davis, was in 1684. Davis, Wafer, Knight and Harris were there again the next year, and in 1687 Davis and Wafer made a third visit.

It is to Dampier that we owe the first account of the land tortoises. He visited the Galapagos Islands several times, and in his *New Voyage Round the World,* published in 1697, tells us:

"The land-turtles are so numerous that five or six hundred men might subsist on them alone for several months, without any other sort of provision. They are extraordinary large and fat, and so sweet that no pullet eats more pleasantly. One of the largest of these creatures will weigh 150 or 200 weight, and some of them are two foot, or two foot six inches, over the callapee or belly."

In a later edition of his *Voyages* Dampier states:

"The oil saved from them was kept in jars, and used instead of butter to eat with dough-boys or dumplings. We lay here

feeding sometimes on land-turtle, sometimes on sea-turtle, there being plenty of either sort; but the land-turtle, as they exceed in sweetness, so do they in numbers; it is incredible to report how numerous they are."

The French Captain, de Beauchesne, visited these islands in June, 1700, but his account is said to add nothing to the history of the land tortoises.

The best of the earlier accounts of the tortoises is that of Woodes Rogers, who was in the Galapagos Archipelago in September, 1707. I quote as follows:

"Some of the largest of the land-turtles are about 100 pounds weight, and those of the sea upwards of 400. The land-turtles laid eggs on our deck. Our men brought some from the shore about the bigness of a goose egg, white, with a large big shell, exactly round. The creatures are the ugliest in Nature, the shell not unlike the top of an old hackney-coach, as black as jet; and so is the outside skin, but shriveled and very rough. The legs and necks are very long, and about the bigness of a man's wrist; and they have club-feet, as big as one's fist, shaped much like those of an elephant, with five thick nails on the fore-foot and but four behind, and the head little, and visage small like snakes, and look very old and bleak. When at first surprised they shrink their neck, head, and legs under their shell. Two of our men, with Lieutenant Stratton and the trumpeter of the Duchess, affirm they saw vast large ones of this sort, about four feet high. They mounted two men on the back of one of them, which, with its usual slow pace, carried them and never regarded the weight. They supposed this could not weigh less than 700 pounds. I do not affect giving relations of strange creatures so frequently done by others; but when an uncommon creature falls in my way, I cannot omit it. The Spaniards tell us, they know of none elsewhere in these seas, but they are common in Brazil."

Different islands were visited by Rogers. He continues:

"I saw no sort of beast, but there are guanos [iguanas] in abundance, and land-turtles almost on every island. It is strange how the latter got here, because they cannot come of themselves, and none of that sort are found on the main."

In 1720, Clipperton was for ten days in these islands. Vancouver, who determined the position of some in 1795, did not go to land.

Captain James Colnett, whose *Voyage to the South Atlantic* was published in 1798, surveyed the Galapagos Archipelago in 1793. He was the first to mention the presence of tortoises on Abingdon Island.

Amasa Delano first visited the Galapagos Islands in 1800 but returned there later. He reports tortoises still abundant on Hood, Charles, James, and Albemarle islands. In his *Narrative of Voyages and Travels,* published in Boston in 1817, with a second edition in 1818, he says:

"The terrapin, or, as it is sometimes called, the land tortoise, that is found here, is by far the largest, best, and most numerous of any place I have ever visited. Some of the largest weigh three or four hundred pounds, but their common size is between fifty and one hundred pounds. They have a very long neck, which, together with their head, has a very disagreeable appearance, very much resembling a large serpent. I have seen them with necks between two and three feet long, and when they saw anything that was new to them, or met each other, they would raise their heads as high as they could, their necks being nearly vertical, and advance with their mouths wide open, appearing to be the most spiteful of any reptile whatever; sometimes two of them would come up to each other in that manner, so near as almost to touch, and stand in that position for two or three minutes, appearing so angry that their mouths, heads, and necks appeared to quiver with passion; when by the least touch of a stick against their necks or heads, they would sink back in an instant, and draw their necks, heads, and legs into their shells. This is the only quick motion I ever saw them perform. I was put in the same kind of fear that is felt at the sight or near approach of a snake at the first one I saw, which was very large. I was alone at the time, and he stretched himself as high as he could, opened his mouth, and advanced toward me. His body was raised more than a foot from the ground, his head turned forward in the manner of a snake in the act of biting, and raised two feet and a half above his body. I had a musket in my hand at the time, and when he advanced near enough to reach him with it, I held the muzzle out so that he hit his neck against it, at the touch of which he dropped himself upon the ground and instantly secured all his limbs within his shell. They are per-

fectly harmless, as much so as any animal I know of, notwithstanding their threatening appearance. They have no teeth, and of course cannot bite very hard. They take their food into their mouths by the assistance of the sharp edge of the upper and under jaw, which shut together one a little within the other, so as to nip grass, or any flowers, berries, or shrubbery, the only food they eat.

"Those who have seen the elephant have seen the exact resemblance of the leg and foot of a terrapin. I have thought that I could discover some faint resemblance to that animal in sagacity. They are very prudent in taking care of themselves and their eggs, and in their manner of securing them in their nests; and I have observed on board my own ship, as well as on others, that they can easily be taught to go to any place on the deck which may be fixed for them to be constantly kept in. The method to effect this is by whipping them with a small line when they are out of place, and to take them up and carry them to the place arranged for them, which being repeated a few times will bring them into the practice of going themselves, by being whipped when they are out of their place. They can be taught to eat on board a ship as well as a sheep or a goat, and will live for a long time if there is proper food provided for them. This I always took care to do when in a place where I could procure it. The most suitable to take on board a ship is prickly pear-trees, the trunk of which is a soft, pithy substance, of a sweetish taste, and full of juice. Sometimes I procured grass for them. Either of these being strewed on the quarter-deck, the pear-tree being cut fine, would immediately entice them to come from all parts of the deck to it; and they would eat in their way as well as any domestic animal. I have known them to live several months without food; but they always in that case grow lighter and their fat diminishes, as common sense teaches, notwithstanding some writers have asserted the contrary. If food will fatten animals, to go without it will make them lean.

"I carried at one time from James Island three hundred very good terrapins to the island of Massa Fuero, and there landed more than one-half of them, after having them sixty days on board my ship. Half of the number landed died as soon as they took food. This was owing to the stomachs

having got so weak and out of tone that they could not digest it. As soon as they eat any grass after landing they would froth at the mouth, and appeared to be in a state of insanity, and died in the course of a day or two. This satisfied me that they were in some degree like other animals, and only differed from them by being slower in their motions, and that it takes a longer time to produce an effect upon their system than upon that of other creatures. Those that survived the shock which was occasioned by this sudden transition from total abstinence to that of abundance, soon became tranquil, and appeared to be as healthy and as contented with the climate as when they were at their native place, and they would probably have lived as long had they not been killed for food. Their flesh, without exception, is of a sweet and pleasant flavor as any that I ever ate. It was common to take out of one of them ten or twelve pounds of fat when they were opened, besides what was necessary to cook them with. This was as yellow as our best butter, and of a sweeter flavor than hog's lard. They are the slowest in their motions of any animal I ever saw except the sloth. They are remarkable for their strength; one of them would bear a man's weight on his back and walk with him. I have seen them at one or two other places only. One instance was those brought from Madagascar to the Isle of France, but they were far inferior in size, had longer legs, and were much more ugly in looks than those of the Galapagos Islands. I think I have likewise seen them at some of the Oriental Islands which I visited.

"I have been more particular in describing the terrapin than I otherwise should have been, had it not been for the many vague accounts given of it by some writers, and the incorrect statements made of the country in which it is to be found. The frequent political comparisons and allusions which have been made by our public papers and orators to this animal, may have led the people of this country into incorrect notions concerning them. It has been publicly said that terrapins are common to China, which I am confident is incorrect; for I have carried them to Canton at two different times, and every Chinese who came on board my ship was particularly curious in inspecting and asking questions about them, and not one, I am positive, had any knowledge of the animal before."

During the War of 1812, Captain, afterward Admiral, Porter of the United States navy, spent some time in the Galapagos Archipelago. He has given, in his *Journal of a Cruise Made to the Pacific Coast,* the most complete of the earlier accounts of these tortoises. It was he who first called attention to differences existing between the tortoises of the different islands. Tortoises were found in greater or less abundance in all the larger islands of the group which he visited, viz.: Hood, Marlborough, James, Charles, and Indefatigable (Porter's) islands. On Chatham Island, where he made a short stay, a few of their shells and bones were seen, but they appeared to have been long dead; and on Albemarle Island, the largest of the group, none was observed by him, evidently because he landed here only a few hours on the southwestern point. Abingdon, Bindloe, Downe, and Barrington islands were not visited by him. Some of the tortoises captured weighed from 300 to 400 pounds. On Indefatigable Island land tortoises were in the greatest abundance, of an enormous size, one of which measured five feet and a half long, four feet and a half wide, and three feet thick, and others were found by some of the seamen of larger size. On Hood Island he obtained tortoises in great numbers. On another visit he could not procure more than fifty tortoises, and they were small, but "of a quality far superior to those found on James Island." In regard to Charles Island he says:

"It abounds with tortoises, which frequent the springs for the sake of the water, and upwards of thirty of them were turned on their backs by us, as they came down to drink, during the short time we remained there, which was not more than an hour and a half. But we were enabled to bring down only one, and he was selected more for his antiquated appearance than for his size or supposed excellence. His weight was exactly one hundred and ninety-seven pounds, but he was far from being considered a large size. Later, between four and five hundred were taken on board. They were brought the distance of from three to four miles, through thorns and over sharp rocks, yet it was no uncommon thing for them to make three and four trips a day, each with tortoises weighing from fifty to a hundred weight.

"Although the parties in this employment (which were selected every day, to give all an opportunity of going on shore), indulged themselves in the most ample manner on tortoise meat (which for them was called Galapagos mutton), yet their relish for this food did not seem in the least abated, nor their exertions to get them on board in the least relaxed, for everyone appeared desirous of securing as large a stock of this provision as possible for the cruise."

Two vessels captured by Porter—"had been in at James Island, and had supplied themselves abundantly with these extraordinary animals, the tortoises of the Galapagos, which properly deserve the name of the elephant tortoise. Many of them were of a size to weigh upwards of three hundred weight. Numbers of them had been thrown overboard by the crews of the vessels before their capture, to clear them for action. A few days afterwards, at daylight in the morning, we were so fortunate as to find ourselves surrounded by about fifty of them, which were picked up and brought on board, as they had been lying in the same place where they had been thrown over, incapable of any exertion in that element, except that of stretching out their long necks."

Two other English vessels captured later, had been only a few days from James Island. Porter—"found on board them eight hundred tortoises of a very large size, and sufficient to furnish all the ships with fresh provisions for one month."

At another time Porter laid in a very large stock of tortoises from James Island.

"Four boats were dispatched every morning for this purpose, and returned at night, bringing with them twenty to thirty each, averaging sixty pounds. In four days we had as many on board as would weigh about fourteen tons, which was as much as we could conveniently stow. They were piled up on the quarter-deck for a few days, with an awning spread over to shield them from the sun, which renders them very restless, in order that they might have time to discharge the contents of their stomachs; after which they were stowed away below, as you would stow any other provisions, and used as occasion required. No description of stock is so convenient for ships to take to sea as the tortoises of these islands. They require no provisions or water for a year, nor is any farther

attention to them necessary, than that their shells should be preserved unbroken. * * * The most of those we took on board were found near a bay on the northeast part of the Island, about eighteen miles from the ship. Among the whole only three were male, which may be easily known by their great size, and from the length of their tails, which are much longer than those of the females. As the females were found in low sandy bottoms, and all without exception were full of eggs, of which generally from ten to fourteen were hard, it is presumable that they came down from the mountains for the express purpose of laying. This opinion seems strengthened by the circumstance of there being no male tortoises among them, the few we found having been taken a considerable distance up the mountains. One remarkable peculiarity in this animal is, that the blood is cold. I shall leave it to those better acquainted with natural history to investigate the cause of a circumstance so extraordinary, my business is to state facts, not to reason from them.

"Nothing, perhaps, can be more disagreeable or clumsy than they are in their external appearance. Their motion resembles strongly that of the elephant; their steps slow, regular and heavy, they carry their body about a foot from the ground, and their legs and feet bears no slight resemblance to the animal to which I have likened them; their neck is from eighteen inches to two feet in length, and very slender; their head is proportioned to it, and strongly resembles that of a serpent. But, hideous and disgusting as is their appearance, no animal can possibly afford a more wholesome, luscious and delicate food than they do; the finest green-turtle is no more to compare to them in point of excellence than the coarsest beef is to the finest veal; and after once tasting the Galapagos tortoises, every other animal food fell greatly in our estimation. These animals are so fat as to require neither butter nor lard to cook them, and their fat does not possess that cloying quality, common to that of most other animals. When fried out, it furnishes an oil superior in taste to that of the olive. The meat of this animal is the easiest of digestion, and a quantity of it exceeding that of any other food, can be eaten without experiencing the slightest inconvenience. But what seems the most extraordinary in this animal, is the length of time that it

can exist without food; for I have been well assured that they have been piled away among the casks in the hold of a ship, where they have been kept eighteen months, and when killed at the expiration of that time, were found to have suffered no diminution in fatness or excellence. They carry with them a constant supply of water, in a bag at the root of the neck, which contains about two gallons, and on testing that found in those we killed on board, it proved perfectly fresh and sweet. They are very restless when exposed to the light and heat of the sun, but will lie in the dark from one year's end to the other without moving. In the daytime, they appear remarkably quick-sighted and timid, drawing their head into their shell on the slightest motion of any object; but they are entirely destitute of hearing, as the loudest noise, even the firing of a gun, does not seem to alarm them in the slightest degree, and at night or in the dark they appear perfectly blind. * * * The shells of those of James Island are sometimes remarkably thin and easily broken, but more particularly so as they become advanced in age; when, whether owing to the injuries they receive from their repeated falls in ascending and descending the mountain, or from injuries received otherwise, or from the course of nature, their shells become very rough, and peel off in large scales, which renders them very thin and easily broken. Those of James Island appear to be a species entirely distinct from those of Hood and Charles islands. The form of the shell of the latter is elongated, turning up forward in the manner of a Spanish saddle, of a brown color and of considerable thickness. They are very disagreeable to the sight, but far superior to those of James Island in point of fatness, and their livers are considered the greatest delicacy. Those of James Island are round, plump, and black as ebony, some of them handsome to the eye, but their liver is black, hard when cooked, and the flesh altogether not so highly esteemed as the others. * * * [The tortoises of Hood's Island] were of a quality far superior to those found on James Island. They were similar in appearance to those of Charles Island, very fat and delicious."

Porter proceeded, after his cruise round the Galapagos, to the Marquesas Islands, making a prolonged stay at Madison [Rotumah] Island, where he "distributed from his stock sev-

eral young tortoises among the chiefs, and permitted a great many to escape into the bushes and among the grass."

Captain Basil Hall found tortoises plentiful on Abingdon Island in January, 1822.

Captain Benjamin Morrell, in 1823 and again in 1825, hunted fur-seals in the Galapagos Archipelago, taking some five thousand skins in about two months. He states that tortoises "grow to even a greater size than that mentioned by Commodore Porter, as I have seen some that would weigh from six to eight hundred pounds. They are excellent food, and have no doubt saved the lives of thousands of seamen employed in the whale-fishing in those seas, both American and Englishmen. I have known whale-ships to take from six to nine hundred of the smallest size of these tortoises on board when about leaving the islands for their cruising grounds; thus providing themselves with provisions for six or eight months, and securing the men against the scurvy. I have had these animals on board my own vessels from five to six months without their once taking food or water; and on killing them I have found more than a quart of sweet fresh water in the receptacle which nature has furnished them for that purpose, while their flesh was in as good condition as when I first took them on board. They have been known to live on board of some of our whale-ships for fourteen months under similar circumstances, without any apparent diminuation of health or weight."

In February, 1825, Morrell observed a terrible eruption on Narborough Island. One hundred and eighty-seven tortoises were taken on Indefatigable between October 27 and November 10, 1825.

During all this time the Galapagos Islands remained without permanent inhabitants, with the exception of an Irishman, Patrick Watkins, who lived on Charles Island in 1809. It was in 1832 that the first colony was established. This was due to the exertions of J. Vilamil, who, although a native of Louisiana, had long been resident in Guayaquil, Ecuador. Political difficulties delayed his enterprise some twenty years, but finally, in 1831, the Government of Ecuador granted him a charter conceding possession of the islands and authorizing the establishment of a colony.

September 30, 1914.

In January of the following year Colonel Hernandez, with twelve colonists, was sent to take possession of Charles Island, and settlers of both sexes followed in April and June. In October, 1832, Vilamil himself, with eighty colonists, arrived and "at once assumed his station as proprietor and governor of the island." The colony grew until it numbered several hundred persons, many of whom, it is said, had been banished from the mainland. These people and the domestic animals introduced, many of which multiplied and roamed at large, reduced the number of tortoises upon Charles Island so rapidly and to such an extent that within three years the people were obliged to send hunting parties to other islands to procure a supply for food. This colony later was removed to Chatham Island, where there still is a considerable settlement.

In 1833, Commodore John Downes visited Charles Island in the U. S. Frigate "Potomac." He obtained tortoises there, and carried some to Boston.

In the year 1835 the Galapagos Islands, for the first time in their history, were visited by a naturalist. In that year, Charles Darwin, during the voyage of the "Beagle," spent the weeks from September 15 to October 20 in this archipelago. In his classical *Journal* he has given by far the best account of the habits of the tortoises that has been written.

"The 'Beagle' sailed around Chatham Island, and anchored in several bays. One night I slept on shore on a part of the island, where black truncated cones were extraordinarily numerous: from one small eminence I counted sixty of them, all surmounted by craters more or less perfect. The greater number consisted merely of a ring of red scoriæ or slags, cemented together: and their height above the plain of lava was not more than from fifty to a hundred feet: none had been very lately active. The entire surface of this part of the island seems to have been permeated, like a sieve, by the subterranean vapors: here and there the lava, while soft, has been blown into great bubbles; and in other parts, the tops of caverns similarly formed have fallen in, leaving circular pits with steep sides. From the regular form of the many craters, they gave to the country an artificial appearance, which vividly reminded me of those parts of Staffordshire where the great iron foundries are most numerous. The day was glowing hot,

and the scrambling over the rough surface and through the intricate thickets was very fatiguing; but I was well repaid by the strange Cyclopean scene. As I was walking alone I met two large tortoises, each of which must have weighed at least two hundred pounds: one was eating a piece of cactus, and as I approached, it stared at me and slowly stalked away; the other gave a deep hiss, and drew in its head. These huge reptiles, surrounded by the black lava, the leafless shrubs, and large cacti, seemed to my fancy like some antediluvian animals. The few dull colored birds cared no more for me than they did for the great tortoises.

"The 'Beagle' proceeded to Charles Island. This archipelago has long been frequented, first by the buccaneers, and latterly by whalers, but it is only within the last six years that a small colony has been established here. The inhabitants are between two and three hundred in number: they are nearly all people of color, who have been banished for political crimes from the Republic of the Equator, of which Quito is the capital. The settlement is placed about four and a half miles inland, and at a height probably of a thousand feet. In the first part of the road we passed through leafless thickets, as in Chatham Island. Higher up, the woods gradually became greener; and as soon as we crossed the ridge of the island we were cooled by a fine southerly breeze, and our sight refreshed by a green and thriving vegetation. In this upper region coarse grasses and ferns abound; but there are no tree-ferns: I saw nowhere any member of the Palm family, which is the more singular as, 360 miles northward, Cocos Island takes its name from the number of cocoanuts. The houses are irregularly scattered over a flat space of ground, which is cultivated with sweet potatoes and bananas. It will not easily be imagined how pleasant the sight of black mud was to us, after having been so long accustomed to the parched soil of Peru and northern Chile. The inhabitants, although complaining of poverty, obtain, without much trouble, the means of subsistance. In the woods there are many wild pigs and goats; but the staple article of animal food is supplied by the tortoises. Their numbers have of course been greatly reduced in this island, but the people yet count on two days' hunting giving them food for the rest of the week. It is said that formerly single vessels have taken

away as many as seven hundred, and that the ship's company of a frigate some years since brought down in one day two hundred tortoises to the beach.

"October 8th.—We arrived at James Island: this island, as well as Charles Island, were long since thus named after the kings of the Stuart line. Mr. Bynoe, myself, and our servants were left here for a week, with provisions and a tent, while the 'Beagle' went for water. We found here a party of Spaniards, who had been sent from Charles Island to dry fish and to salt tortoise-meat. About six miles inland, and at the height of nearly 2,000 feet a hovel had been built in which two men lived, who were employed in catching tortoises, while the others were fishing on the coast. I paid this party two visits, and slept there one night. As in the other islands, the lower region was covered by nearly leafless bushes, but the trees were here of a larger growth than elsewhere, several being two feet and some even two feet nine inches in diameter. The upper region being kept damp by the clouds supports a green and flourishing vegetation. So damp was the ground that there were large beds of coarse *Cyperus,* in which great numbers of a very small water-rail lived and bred. While staying in this upper region we lived entirely upon tortoise-meat: the breast-plate roasted (as the Gauchos do *carne con cuero*), with the flesh on it, is very good; and the young tortoises make excellent soup; but otherwise the meat to my taste is indifferent. * * *

"Of sea-turtle I believe there is more than one species; and of tortoises there are, as we shall presently show, two or three species or races.

"I have not as yet noticed by far the most remarkable feature in the natural history of this archipelago; it is, that the different islands to a considerable extent are inhabited by a different set of beings. My attention was first called to this fact by the Vice-Governor, Mr. Lawson, declaring that the tortoises differed from the different islands, and that he could with certainty tell from which island any one was brought. I did not for some time pay sufficient attention to this statement, and I had already partially mingled together the collection from two of these islands. I never dreamed that islands, about fifty or sixty miles apart, and most of them in sight of each other, formed of precisely the same rocks, placed

under a quite similar climate, rising to a nearly equal height, would have been differently tenanted; but we shall soon see that this is the case. It is the fate of most voyagers, no sooner to discover what is most interesting in any locality than they are hurried from it; but I ought, perhaps, to be thankful that I obtained sufficient materials to establish this most remarkable fact in the distribution of organic beings.

"The inhabitants, as I have said, state that they can distinguish the tortoises from the different islands; and that they differ not only in size, but in other characters. Captain Porter has described those from Charles and from the nearest island to it, namely, Hood Island, as having their shells in front thick and turned up like a Spanish saddle, while the tortoises from James Island are rounder, blacker, and have a better taste when cooked. M. Bibron, moreover, informs me that he has seen what he considers two distinct species of tortoise from the Galapagos, but he does not know from which islands. The specimens that I brought from three islands were young ones; and probably owing to this cause, neither Mr. Gray nor myself could find in them any specific differences.

"I will first describe the habits of the tortoise *(Testudo nigra,* formerly called *Indica),* which has been so frequently alluded to. These animals are found, I believe, on all the islands of the archipelago; certainly on the greater number. They frequent in preference the high damp parts, but they likewise live in the lower and arid districts. I have already shown, from the numbers which have been caught in a single day, how very numerous they must be. Some grow to an immense size: Mr. Lawson, an Englishman, and Vice-Governor of the colony, told us that he had seen several so large that it required six or eight men to lift them from the ground; and that some had afforded as much as two hundred pounds of meat. The old males are the largest, the females rarely growing to so great a size; the male can readily be distinguished from the female by the greater length of its tail. The tortoises which live on those islands where there is no water, or in the lower and arid parts of the others, feed chiefly on the succulent cactus. Those which frequent the higher and damp regions eat the leaves of various trees, a kind of berry (called *guayavita*) which is acid and austere, and likewise a pale

green filamentous lichen (*Usnea plicata*) that hangs in tresses from the boughs of the trees.

"The tortoise is very fond of water, drinking large quantities and wallowing in the mud. The larger islands alone possess springs, and these are always situated toward the central parts, and at a considerable height. The tortoises, therefore, which frequent the lower districts, when thirsty, are obliged to travel from a long distance. Hence broad and well-beaten paths branch off in every direction from the wells down to the sea-coast; and the Spaniards, by following them up, first discovered the watering places. When I landed at Chatham Island, I could not imagine what animal traveled so methodically along well-chosen tracks. Near the springs it was a curious spectacle to behold many of these huge creatures, one set eagerly traveling onward with outstretched necks, and another set returning, after having drunk their fill. When the tortoise arrives at the spring, quite regardless of any spectator, he buries his head in the water above his eyes, and greedily swallows great mouthfuls, at the rate of about ten in a minute. The inhabitants say each animal stays three or four days in the neighborhood of the water, and then returns to the lower country; but they differed respecting the frequency of these visits. The animal probably regulates them according to the nature of the food on which he has lived. It is, however, certain that tortoises can subsist even on those islands where there is no other water than what falls during a few rainy days in the year.

"I believe it is well ascertained that the bladder of the frog acts as a reservoir for the moisture necessary to its existence: such seems to be the case with the tortoise. For some time after a visit to the springs, their urinary bladders are distended with fluid, which is said gradually to decrease in volume, and to become less pure. The inhabitants, when walking in the lower district, and overcome with thirst, often take advantage of this circumstance, and drink the contents of the bladder if full: in one I saw killed, the fluid was quite limpid, and had only a very slightly bitter taste. The inhabitants, however, always first drink the water in the pericardium, which is described as being best.

"The tortoises, when purposely moving toward any point, travel by night and day, and arrive at their journey's end much sooner than would be expected. The inhabitants, from observing marked individuals, consider that they travel a distance of about eight miles in two or three days. One large tortoise, which I watched, walked at the rate of sixty yards in ten minutes, that is 360 yards in the hour, or four miles a day—allowing a little time for it to eat on the road. During the breeding season, when the male and female are together, the male utters a hoarse roar or bellowing, which, it is said, can be heard at the distance of more than a hundred yards. The female never uses her voice, and the male only at these times; so that when the people hear this noise they know that the two are together. They were at this time (October) laying their eggs. The female, when the soil is sandy, deposits them together, and covers them up with sand; but when the ground is rocky she drops them indiscriminately in any hole: Mr. Bynoe found seven placed in a fissure. The egg is white and spherical; one which I measured was seven inches and three-eighths in circumference, and therefore larger than a hen's egg. The young tortoises, as soon as they are hatched, fall a prey in great numbers to the carrion-feeding buzzards. The old ones seem generally to die from accidents, as from falling down precipices: at least several of the inhabitants told me that they had never found one dead without some evident cause.

"The inhabitants believe that these animals are absolutely deaf; certainly they do not overhear a person walking close behind them. I was always amused when overtaking one of these great monsters, as it was quietly pacing along, to see how suddenly, the instant I passed, it would draw in its head and legs, and uttering a deep hiss fall to the ground with a heavy sound, as if struck dead. I frequently got on their backs, and then giving a few raps on the hinder part of their shells, they would rise up and walk away—but I found it very difficult to keep my balance. The flesh of this animal is largely employed, both fresh and salted; and a beautifully clear oil is prepared from the fat. When a tortoise is caught, the man makes a slit in the skin near its tail, so as to see inside its body, whether the fat under the dorsal plate is thick.

If it is not, the animal is liberated; and it is said to recover soon from this strange operation. In order to secure the tortoises, it is not sufficient to turn them like turtle, for they are often able to get on their legs again.

"There can be little doubt that this tortoise is an aboriginal inhabitant of the Galapagos; for it is found on all, or nearly all, the islands, even on some of the smaller ones where there is no water; had it been an imported species, this would hardly have been the case in a group which has been so little frequented. Moreover, the old buccaneers found this tortoise in greater numbers even than at present: Wood and Rogers also, in 1708, say that it is the opinion of the Spaniards that it is found nowhere else in this quarter of the world."

The visit of the French frigate "Vénus," from June 21 to July 15, 1838, needs merely to be mentioned; while that of the English "Herald," from January 6 to 16, 1846, is chiefly of interest because of the statement of its naturalist, B. Seemann, that "no turpin, or terrapin, are living" on Charles Island where wild dogs, pigs, goats and cattle had increased wonderfully. Terrapin or galapago were bought on Chatham Island at the rate of six shillings apiece, and were two feet two inches in length, one foot ten inches broad, and stood one foot two inches off the ground."

Dr. Kinberg in the Swedish vessel "Eugenie," in 1852, collected reptiles on Charles, Chatham, Indefatigable, James and Albemarle islands. Nothing of importance was discovered regarding the tortoises. The same may be said concerning the researches of Dr. Habel, who, from July 22, 1868, to January 1, 1869, made collections of birds, fishes, snakes, lizards, insects, mollusks, and radiates on Abingdon, Bindloe, Hood, and Indefatigable islands.

From June 10 to 19, 1872, the Hassler Expedition, under Professor Louis Agassiz, collected chiefly fishes, at Charles, Albemarle, Indefatigable, James, and Jervis islands. It is said that a female tortoise was purchased by Professor Agassiz on Charles Island.

In the year 1875, Commander Cookson of the British navy, visited the Galapagos in the "Peterel." He obtained tortoises on Albemarle and Abingdon islands. The following notes are extracted from his report to Rear-Admiral Cochrane who, at

the suggestion of Dr. Günther, had instructed him to obtain the desired information and specimens.

"These tortoises are extinct in Charles Island; and only a very few individuals are supposed to survive on Chatham Island. In Hood, James, and Indefatigable islands the numbers are so reduced that they are no longer hunted, the few left being in the most inaccessible parts of the islands; and I was assured that a search of a fortnight might not result in finding a single individual on either of these islands. Albemarle and Abingdon are the only remaining islands in which they have ever been found. In parts of Albemarle Island they are still very abundant, especially at the south-east end.

"They are still tolerably numerous near Tagus Cove. Landing a party of twenty-four men about half a mile south-east of Tagus Cove, we found in a few hours thirty tortoises; the three largest weighed respectively 241 pounds, 185 pounds, and 173 pounds; these, I was told, were as large as they are commonly found now.

"Tagus Cove is a favorite resort of whalers for the purpose of getting tortoises. The anchorage is perfectly secure; and the custom is for almost the entire crew to be landed until as many tortoises are secured as can be conveniently taken on board, some whalers going to sea with as many as 100.

"We found a good trail leading from the landing-place (at one of the gullies before mentioned as having pools of fresh water at its mouth) to the ground where tortoises are found, a distance of about three miles; quantities of tortoise-shells and traces of fires showed the numerous camping-grounds.

"Tortoises were never, I believe, very abundant on Abingdon Island: our searching party found four on this island. They were on the high ground; and it was a work of great labour getting them down to the boats. The distance was about four miles; but the ground was exceedingly rugged, and covered with thick brush, through which a trail had to be cut for the entire distance. The largest found on this island weighed 201 pounds, and the smallest 135 pounds.

"In consequence of the extent of Albemarle Island, and the inaccessibility of many parts of it, I have no doubt these animals are still very numerous on it, and likely to be so for a long period, even at the present rate at which they are

destroyed; but I have already shown the havoc made amongst them by the oil-makers. This is the cause of their being nearly extinct on James and Indefatigable islands, where they used to be so numerous. Admiral Fitzroy found a party on James Island making oil in 1835.

"In Abingdon Island, where they are not numerous, I believe they are doomed to destruction directly the orchilla-pickers are placed on the island; for a party of sixty or eighty men will soon hunt over this small island and discover every individual on it."

The "Challenger" reached the Galapagos Islands shortly after the "Peterel." It carried home some of the tortoises secured by Commander Cookson, but obtained no additional information.

In April (4-16), 1888, the United States Fish Commission steamer "Albatross" collected reptiles on Albemarle, Charles, Chatham, Duncan, and Indefatigable islands. Tortoises were secured on Albemarle and Duncan. A second visit by the "Albatross" with Professor A. Agassiz, from March 28 to April 4, 1891, resulted in no new information concerning tortoises.

On June 10, 1891, Dr. George Baur and Mr. C. F. Adams reached the Galapagos Islands. They remained until September 6 of the same year, and collected on Albemarle, Abingdon, Bindloe, Barrington, Charles, Chatham, Duncan, Hood, Indefatigable, James, Jervis, and Tower islands. Tortoises were found only on Duncan and in southern Albemarle. Twenty-one specimens were collected—eight on Duncan and thirteen from southeastern Albemarle.

Acting for the Hon. Walter Rothschild, Mr. Frank B. Webster, in 1897, organized an expedition to search for tortoises in the Galapagos Archipelago, under the leadership of Mr. C. M. Harris. The original party having been broken up at Panama by the death from yellow fever of three of its five members, a second party was gathered at San Francisco, where Harris had chartered the "Lila and Mattie," a small schooner commanded by Captain Linbridge. Those composing the collecting force of the second party were Mr. Harris, Mr. F. P. Drowne, Mr. G. D. Hull, and Mr. R. H. Beck. They set sail from San Francisco June 21, and arrived at the Galapagos

Islands July 25, 1897. Collections were made on Culpepper, Wenman, Abingdon, Bindloe, Indefatigable, Duncan, Jervis, James, Barrington, Chatham, Hood, Charles, southeastern Albemarle, Tagus Cove, Narborough, and Tower islands. Setting sail from Tower Island December 28, 1897, the return to San Francisco was accomplished February 8, 1898. Tortoises were secured only from southeastern Albemarle and from Duncan islands. The following extracts from Mr. Browne's journal tell the difficulties overcome in collecting tortoises on Duncan Island:

"Sept. 5, 1897. After a long walk I arrived at the edge of the crater at about 11 a. m. Harris was already inside. We climbed down the side, I should say 250 feet, and reached the bottom, which was level and covered all around with thick bushes on the border. Grass, 2 feet high or more, covered the entire centre. *Geospiza, Certhidea,* and *Camarhynchus* were abundant, and occasionally *Pyrocephalus* and *Myiarchus* were seen. Soon after reaching the bottom I heard Harris calling out that he had caught a tortoise. Hull and myself got there as soon as possible, and we tied the tortoise up. The grass was full of tortoise trails, and we set out in search of others. Harris found two more, and Hull and myself each two. We turned them all over, and weighted them down with heavy rocks. After fixing the last one, we revisited the first and found it loose. This made it necessary to revisit the others, which we did, finding that they had all got loose. We weighted them down again with more and heavier rocks, and returned to the starting-place. Some of the tortoises which we found feeding were eating the blossoms from a creeping vine, rising upon their forelegs and stretching their necks out to full extent. The odor from them reminded me very much of that from an elephant. After tramping about so much and lifting so many heavy rocks, we were very tired, but had to brace up and climb out of the crater, and walk to the shore over a long distance of broken rock. The crater was quite three-quarters of a mile in diameter, with a very flat bottom, surrounded by a high wall or embankment, making it resemble greatly pictures of the old Roman amphitheaters. Arrived on board at 6:30, very tired and very thirsty.

"Sept. 7.—Another hard day's work. Got up at 4:45 A. M. and started to heave up anchor. Sailed over to Duncan Island. Had breakfast at 6:30, and went ashore soon after, starting immediately up to the crater, with poles, ropes, etc., to get the tortoises out. Managed to recover our tortoises of last Sunday, some of which had got away. Found one dead, a rock having fallen on his neck during his struggles and shut off his wind. Found one more, making a total of eight. The work of making them fast lasted till about 2 o'clock, when we started for the shore with a tortoise strung on a pole between each two men, one of the sailors and myself taking one. It was very hard getting them up the side of the crater, walking being so rough and thorns so plentiful. But this was nothing to be compared with going down on the other side, which was very steep and terrible walking. The sailor had on a pair of wooden clogs, which soon began to chafe his feet. After a long time spent in tumbling over lava blocks, tearing through thorn bushes and other such pleasantries, we reached a point as near the shore as we could, tied the creatures up securely, and left them. Now came a long walk before we could get to the skiff. We were all so tired, having had nothing to eat since breakfast, that the distance seemed terribly long. It was a rough road, up and down, over broken lava and through thorns. Reached the skiff about 6 P. M., every one being well tired out. A good drink of wine and water was served with the lunch that was in the boat. We got aboard the schooner a little later. This was the hardest day's work thus far, with the possible exception of last Sunday's. The trip was very hard on the tortoise also, and they acted as if 'played out.' Two of them being set down close together got their poles somewhat tangled up, and by the way they opened their mouths at each other it looked as if they were going to have a fight.

"Sept. 8.—We went ashore quite early, and started immediately for the crater, after looking in vain for more tortoises for a short time. The mate took a small one on his back. Harris and myself, Hull and Beck carried one swung on a pole between us, and we started for the boat by a much easier route than yesterday, and got two of them right aboard the skiff. The other one and the three brought down yesterday

were tied up in a sack, one at a time, and then lowered down to the skiff from the top of a bluff 75 feet high. Getting them into the skiff, at 4 P. M. we were aboard the schooner with six live tortoises. The small one which was found yesterday appeared to be nearly dead when visited today. The soil at the bottom of the crater is full of cracks in places, showing that probably during the wet season there is water there. There were several rocks with depressions in their tops, and the prints of tortoise feet near them showed that the animals probably relied on these places for their supply of water during the dry season. It rained last Sunday while we were in the crater, and in one of these holes quite a little water had collected.

"Sept. 9.—Went ashore at about 8 A. M., or rather started at that time, it being a long pull to the island. Harris, Hull, and Beck carried the guns, while the mate and a sailor (Herman Jahnke) and myself were to bring down the two tortoises. We got into the crater at about 11 A. M.; picked up the bones of a tortoise that had been found some time before. We saw a snake that was about 1½ ft. long, slender and blackish, with white rings. The mate noticed it first and called me, but I only arrived in time to see it disappearing under the grass, from which we were unable to dislodge it. The mate was afraid of snakes. We ate lunch in the crater. Just as we were commencing, Harris brought in a small tortoise which had escaped last Sunday, the one first caught. The mate claimed that this one bit him while he was tying it up. After lunch we started out of the crater, a sailor and myself carrying the large dead one on a pole, and the mate the live one in a pack on his back. We got down to the bluff in good time, when we lowered them down, and then climbed down ourselves. At a little after 4 P. M. the rest of the party appeared, bringing in another dead tortoise and the small live one, the sack of bones, and some birds. Beck carried a big tortoise from the other side of the island, and reported seeing five others in a gulch on the other side of the crater, three of them being larger than any secured thus far. He said that one of the big ones was feeding on an old dead cactus. We got on board after a long pull, and started over to Conway Bay, where we anchored at 7 P. M.

"Sept. 13.—Got up at 4:30, and, after having coffee, hoisted anchor and set the sails. Weather very foggy, and fine rain. We sailed over to Duncan, went ashore rather late, and all hands started at once for the crater, the idea being to work over the other side of it, and look for the tortoises that Beck had seen as well as others. We found in one of the craters (a section so thickly covered with bushes that it had not been so carefully examined) a good-sized tortoise. This find altered the plans somewhat. The mate and the sailor took the tortoise on a pole, I a sack of bones and their surplus baggage, and after eating lunch started back, the others having gone on. We reached the skiff after a long walk, the others arriving at about the same time. They reported six tortoises tied up, and the remains of another found. We got aboard the vessel about 6 P. M., and sailed for Conway Bay, coming to anchor at 7:30.

"Sept. 16.—Arose at 5 A. M. and had breakfast; then both parties started for the first station with a big tortoise. Reaching there, the mate and myself started down for the beach after water and provisions, there being only half a canteen of water to leave the others for their morning's work. We got to shore in 50 minutes, and started immediately to pack up. The mate took the five-gallon breaker of water, and I the knapsack, well loaded with canned fruit, meat, sardines, bread, sugar, butter, coffee, rice, etc., and three canteens of water. We started back right in the heat of the day, and the mate's load soon exhausted him. We decided that I should go ahead and get to the boys with the water in the canteens, while he came on by short stages. I reached the camp about 1 P. M., very tired by the long walk in the sun. Beck and Hull had carried out three tortoises to the first station. We lunched, and later the mate reached the camp. Hull and myself got a good-sized tortoise into the camp in the afternoon (the farthest away), while Beck brought in a little one on his shoulder. A little later Beck and myself took one of the big ones around the trail to the first station, while Hull brought another little one into the camp, and the mate got several. We sat around the camp-fire awhile after supper, and then retired.

"Sept. 18.—Arose about 5 A. M., it being then quite rainy. After breakfast we got the tents, blankets, etc., packed up, and started for the shore, Beck and the mate each taking a little

tortoise, while Hull and myself carried the tents, etc., all on a pole. Arrived at the shore, after quite a short rest we started up again to bring down some more tortoises. Beck and the mate went up again after dinner, bringing down two more. Meantime Hull and myself got the stuff packed up, the tortoises in the boat, and things arranged for leaving. We then took the skiff, leaving the camp outfit ashore, as we were to return on Monday. The schooner had left Conway Bay some time before, and was quite close by the island; and in a short time we were all on board with our seven tortoises.

"Sept. 20.—Went ashore quite early. We pitched tents and went up to the first station; brought down two tortoises half way, ate a little lunch we had taken up with us, and took a short rest. We went up to the first station again and brought the tortoises down to the shore. The mate cooked a good supper of rice, coffee, meat (canned corned beef), and bread and butter, canned fruit for dessert. We sat around the campfire till 8 o'clock. The seals kept up a continual noise all night.

"Sept. 21.—Had an early breakfast, and all went to the first station. The mate and myself brought a tortoise down to the camp (moved down to shore). While Hull and Beck brought one half way and returned for another, mate and myself ate lunch, then went to half-way station and brought another one down to the shore. Meantime Beck and Hull got theirs down. It was getting late in the afternoon, so we lay off for the remainder of the day.

"Sept. 22.—Got up early. After breakfast we went up to the half-way station and brought down two tortoises; went up again immediately and brought down two more. Had dinner and took a rest. At about 3 P. M. we went up again and brought down two more, which made the last of the twenty-nine tortoises from Duncan Island.

"Sept. 23.—Did not get up quite as early. After breakfast I worked a little around the beach, turning over rocks for marine animals; then secured several lizards. We got the eleven tortoises down on the beach. We then put six into the skiff, together with the outfit. Beck steering, the mate and myself pulled to the vessel, which had come over from Conway Bay. We got aboard all right, and shortly after the rest of the tortoises and Hull were taken aboard. Then we headed off

for Jervis, and anchored at the north side of the island at 5 P. M. We are doubtful if more than two or three tortoises are left on Duncan Island, because our party covered practically all the part of the island where they would be found.

"Sept. 24.—Went ashore on Jervis Island. Fine beach, with a little lagoon right behind it, around the edge of which we found tracks of a tortoise, but were unable to find it after thoroughly searching the island. There is more soil on this island than on any visited thus far. We secured about 115 birds in all."

In the fall of 1898, the Department of Zoology of Stanford University sent to these islands two collectors, Mr. Robert E. Snodgrass and Mr. Edmund Heller. Sailing on the sealing schooner "Julia E. Whalen," they were given an opportunity to collect on every island of the group. Their visit extended from December 10, 1898, to June 26, 1899. Some twelve hundred reptiles were collected. Tortoises were found only on Duncan Island and at Tagus and Iguana Coves, Albemarle Island. Heller thought them extinct on all the other islands except Abingdon. He gives the following account of the habits, based on observation of the three species collected, viz., *Testudo microphyes, T. vicina* and *T. ephippium:*

"Their food consists of various species of grasses and cactus *(Opuntia)*. During the rainy season, and in the moist portions of the islands the year round, grass forms their chief food, especially a large, woody-stemmed, perennial species. During the dry season in the arid portions of the islands, as at Tagus Cove, Albemarle, and on Duncan Island, the *Opuntia* becomes quite an important food plant. The green succulent leaf-like stems of this cactus and its fruit, the prickly pear, are eagerly devoured by the tortoises, regardless of the sharp spines with which they are armed. One specimen collected near Tagus Cove had the whole palate and pharynx bristling with the cactus spines, from which there was apparently no suffering. The juicy cactus stems supply the tortoises with the necessary water in the dry regions where springs are absent, and thus make possible its existence in such localities. Cactus seems to be preferred, when it can be easily secured; all the tortoises we took on board the schooner would take no other kind of food except when compelled by hunger. The *Opuntia* are tree-

like in habit, growing usually to a large size, and it is only the young and smaller plants that are within reach of the tortoises. Grass can be secured much easier, and it is perhaps due to this fact that it forms a larger proportion of their food.

"The tortoises do a great deal of apparently unnecessary traveling; and, though slow, are so persistent in their journeys that they cover several miles a day. Most of the traveling is done early in the morning and late in the afternoon, the hot hours of noon being spent in the shade of some bush, wallowing in the damp soil. The wallowing probably cools them, and incidentally relieves them of a few of the numerous wood ticks (*Amblyoma pilosum*) which infest them at the joints and wherever the skin is thin enough to allow them to pierce it. After heavy rains they delight to wallow in the mud. They are very determined travelers, and once started in a certain direction no obstacles can stop them. Not infrequently they ascend very steep, rocky hills. Sometimes their shells are broken, and occasionally they are killed, by rolling down these inclines, but if uninjured after these falls they will make repeated efforts to reascend until crowned by success. They retire early for the night, drawing in their limbs and neck, and after sunset do not move from the place chosen for the night. Darwin, however, states that they travel both day and night when on their periodical visits to the springs.

"All three of the species we observed make seasonal vertical migrations. Soon after the rainy season they descend the mountains to the grass-covered flats at their bases, to feed and deposit their eggs in the light soil. After the grass has withered, they again ascend the mountains to the moist meadows produced by the trade winds at an elevation of 2,000 feet and above. These migrations are most marked in the dry regions, as at Tagus Cove, Albemarle; but even at Iguana Cove on the same island, where there is an abundance of moisture at lower elevations, a nearly complete migration takes place. On Duncan Island the tortoises scatter out so in the dry season that their movements can scarcely be called a vertical migration. In their seasonal pilgrimages they follow well-established trails used perhaps for generations. These trails radiate from the higher plateaus as a center and usually follow the floors of the canyons to the flats below. Some of the trails are of

considerable length, requiring several days of persistent effort on the part of the tortoise to cover them.

"When surprised they draw in their limbs and necks with a deep hiss, and suspend operations until they think the danger past. No amount of noise seems to frighten them and the Ecuadorians assert that they are deaf. A small one, however, taken at Iguana Cove, Albemarle, learned to recognize the voice of its keeper in a few months, and would come to the gate of its pen when called though the keeper was hidden from its sight.

"The males are sometimes quarrelsome, especially in the breeding season. In fighting the jaws are opened widely, and the animals, raised by outstretched necks and limbs to their greatest height, attack one another. Superior height seems to be quite an advantage in a combat, allowing the taller to bite down upon the head of his adversary. In these fights they seldom succeed in doing much damage. When turned over on their backs they right themselves by swinging their limbs all in the same direction, which causes the animal to rotate and clear the ground, so that by thrusting out their long necks to the ground and pushing with them the body falls over on the plastron. During this operation they usually indulge in much grumbling and groaning as if it were a terrible tax on their anatomy. During the breeding season the males are said to 'bellow like bulls.' The 'bellowing' which we heard consisted of a rather low prolonged note which could not have been heard more than a few yards away.

"The young do not take on their specific characters until nearly adult; they remain very similar in shape, in all the species for a considerable time. All the young observed possessed striated shells, but adults seem to retain or lose this character indifferently in most of the species.

"Growth takes place by additions to the outer border of each plate along the soft white seams, and probably continues as long as life exists; the largest specimens possess the whitish seams which mark the growing edges of the plates. In youth the annual increase is probably much greater than later. A specimen from Iguana Cove, weighing 29 pounds when taken, doubled its original weight in twelve months, accompanied by an increase to the margin of each plate of the carapace of

about half an inch or an inch to the diameter of the plate. Its total gain during the year was: in length of carapace, four inches; in breadth, three inches; and in height, one and one-fourth inches. During the colder winter months the consumption of food was greatly lessened and growth correspondingly retarded. The increase in weight during the summer months amounted to nearly three pounds monthly. This tortoise now [1902] weighs 130 pounds, having gained 100 pounds in three years. This rapid increase may be abnormal, but it shows how rapid their growth may be under favorable conditions of food and warmth, which we believe are even more favorable in the Galapagos where no cool winter season retards their growth."

In 1900 Captain Noyes again visited the Galapagos Archipelago. He searched for tortoises on Duncan Island, but found only four; and stated that he thought no more would be found there. In the southern part of Albemarle, however, he had better luck, securing nineteen tortoises. These were delivered to Mr. Frank B. Webster, who sent seven of them to Rothschild. Mr. Webster states:

"In all about a hundred and twenty-five tortoises from the Galapagos Islands have passed through my hands, the great majority of which were for the Honorable Walter Rothschild. I consider, now that these creatures are so nearly extinct, that any remaining ones will be only stragglers, and will only be secured at a great expense of time, hardship and money."

Early in 1901, Mr. Beck returned to the Galapagos Islands to hunt for tortoises for Mr. Rothschild. One small specimen was taken on Indefatigable February 16, 1901. Duncan Island yielded five tortoises. Three were taken at Tagus Cove, and one at Cape Berkeley, Albemarle Island, and two were secured on Abingdon. The single specimen from Cape Berkeley proved to be a new species and was named by Rothschild *Testudo becki.*

In November of the same year, Mr. Beck again visited the Galapagos Islands, in the little schooner "Mary Sacks." He returned to San Francisco August 15, 1902, with twenty-three dead and twenty-seven living tortoises. Eight or nine of these were from Indefatigable, six from Bank's Bay, three from Tagus Cove, five from Iguana Cove, and the rest from Vilamil.

These tortoises also went to Rothschild's museum at Tring, England. Mr. Beck has published in the seventh report of the New York Zoological Society some interesting notes on the habits of the tortoises. He says, in part:

"The tortoise seemed to have no regular time for feeding, being at all hours of the day eating or walking about. During the middle of the day, if the sun is shining, they keep in the shade of the trees, but if it is cloudy many spend the time wandering back and forth on the trails. We were told by the natives that in the summer the tortoises go up to the top of the mountain; and this statement confirmed my observations of similar habits of other species in the Archipelago.

"We found that the tortoise trails extend up and down the [Vilamil] mountain side for miles, one of the objective points at the lower part of the range being a rocky basin where water collects during rains. By centuries of constant use these rocks have been worn so smooth that it is almost impossible to walk over them after a rain, while they are wet. Once we noticed four tortoises slaking their thirst at a rocky pool near the trail, but during our stay at the ranch the rainfall was so great that every little hollow in the ground held water, and a tortoise could get a drink anywhere.

"One afternoon, while standing under a tree during a heavy downpour, I was surprised to see a big tortoise come slowly down the hill through the wet grass, walk into a rapidly-forming pool of water, take a long drink, and then lie down in the pool. When he settled down, the depth of the water was only two inches; but in a few minutes it had increased to eight inches; and he seemed entirely content, until his attention was attracted to a female tortoise, which also came to the pool to drink. That attraction was the stronger, so he left the water and set out to make her acquaintance.

"After the rain had ceased, I went down the trail some distance and saw another tortoise living in a hollow filled with water. He remained there all night, apparently, for on our return the next morning he was still in it. These two observations rather tended to disprove my theory regarding one of the causes of the annual migration which affects nearly all the species of the Galapagos tortoises. I had formed the opinion that the migration was partly due to the slightly colder

weather and heavy rains high up on the mountains during the winter season, but it would seem from the actions here cited that these causes have but little to do with it after all. With this species *(Testudo vicina),* it might be the mating instinct that causes them to wander down three or four miles from their summer home.

"Love affairs were in full progress during our stay [March 20 to April 2], and the amorous exclamations of the males could be heard at a distance exceeding 300 yards, even in the thick forest. The actions of the tortoises living in the hollows and small valleys along the mountain top were very similar to those of the cattle that occupied the same range. Walking cautiously over a rise we would see perhaps three or four at a water-hole, drinking, and dispersed in the open valley would be others busily nibbling at the short grass. During the heat of the day many would be seen lying in the shallow pools of water that the heavy rains had formed, or under the bushes near by them. One hot day I saw two large tortoises and two young bulls lying side by side under a small tree. Nearby were other cattle, and another large tortoise was headed for the tree, having just left a water-hole a few rods away.

"After seeing on this mountain dozens of tortoises of good size, one wonders where the small ones are; but after spending a few days a-foot and seeing the many wild dogs in that region—descendants of those left years ago by sailing vessels—we can only wonder that so many of the large ones remain. From the time that the egg is laid until the tortoise is a foot long, the wild dogs are a constant menace, and it is doubtful if more than one out of 10,000 escapes. We certainly saw none, and the natives told us that the dogs ate them as fast as they were hatched.

"In November, 1897, we found several nests in the lower edge of the forest. Of these, two had been rifled, and the broken egg-shells were what first attracted our attention to them. All the eggs found on that date (November 12th) were perfectly fresh, and we saw two or three newly dug holes with tortoises but a few feet from them. Most of the nests found were in well-traveled cattle or tortoise trails. They were so placed that the sun shone on them but a few hours each day; when it did it was very hot. Ordinarily it was very

difficult to recognize the site of a nest, the very slight elevation in the trail, or slightly fresher-looking earth being our sole guide. Several times we imagined that we had discovered nests, and prodded about with our sticks and dug with our hands, until finally we realized that we had misinterpreted the signs.

"On finding our first nests in the trail, the old adage, 'Don't put all your eggs into one basket,' was forcibly brought to mind. This is the rule that is followed by the tortoise, for within a radius of 15 feet four nests were found, each containing 8 to 17 eggs. The holes were about 15 inches in depth, and nearly a foot in diameter. The eggs were placed in layers of 3 to 6, the first layer being on the soft soil on the bottom, separated from the next by an inch or so of dirt, and the second layer separated from the third in the same manner. The dirt surrounding the eggs was loose, but the top of the hole was covered to a depth of 3 or 4 inches with a very hard crust that had probably been formed by the tortoise lying on it and working from side to side in the same manner that we frequently noticed them working down a form to lie in.

"Judging by the size and number of the eggs found in several of the tortoises that we dissected, it would seem that one or two nests are finished at a given period, and a week or two later the remainder of the eggs are laid. From 10 to 20 eggs were ready for extrusion together, while 20 or 30 more were from one-half to two-thirds the normal size.

"At the rate of destruction now in progress it will require but a few years to clear this entire mountain of tortoises; and when we see the methods pursued by the proprietor in getting tortoise oil for shipment to the mainland, we know that the large tortoises can last but a few months after the work of the oil-hunter begins in earnest.

"To show what has already been done by oil-hunters, I took two photographs at the water-hole, where lay the largest number of tortoise skeletons. There were about 150 skeletons at this pool, and a half mile away, in another depression, were about 100 more. While there were more skeletons at these two places than we saw elsewhere, frequently 10 or 15 were observed in other basins where the tortoises had gone for water.

"The outfit of the oil-hunter is very simple, consisting merely of a can or pot in which to try out the oil, and three or four burros for carrying the five- or ten-gallon kegs in which it is transported to the settlement. After making a camp near a water-hole, and killing the tortoises there, the collector brings up a burro, throws a couple of sacks over the pack-saddle, and starts out to look for more tortoises, killing them wherever found. A few strokes of the machete separate the plastron from the body, and 10 minutes' work will clear the fat from the sides. The fat is then thrown into the sack, and the outfit moves on.

"When the burro is well laden, man and beast travel back to camp, where the oil is tried out. Each large tortoise yields from one to three gallons of oil. The small ones are seldom killed, because they have but little fat. By daily visits to the few water-holes during the driest season, in the course of a month the hunters get practically all the tortoises that live on the upper part of the mountain.

"When we first stepped ashore at the settlement we saw a number of casks lying on the beach, and learned on inquiry that they contained 800 gallons of tortoise oil. In a large boat, under a nearby shed, were 400 gallons more. While we were there, the boat sailing between the island and Guayaquil left for the port with those casks and a cargo of hides. The value of the oil in Guayaquil was about $9.00 (American) per 100 pounds. While the tortoises are so plentiful as we saw them, this price yields a fair profit to the hunters, but two more raids such as that shown in the photograph will clear that mountain of all the fair-sized tortoises upon it, and then the oil business is ended."

The statements of the various authors to whom we have referred, indicate that tortoises had been found upon Abingdon, James, Duncan, Indefatigable, Chatham, Charles, Hood, and Albemarle islands; that they remain in considerable numbers only in parts of Albemarle, and perhaps Duncan; that they reached the verge of extinction on Charles Island as early as 1846; and that none had been seen in recent years upon James, Chatham, Charles, or Hood island.

It was largely for the purpose of gathering further information regarding tortoises that an expedition was sent to the

Galapagos Archipelago by the California Academy of Sciences. This expedition set sail from San Francisco on the twenty-eighth of June, 1905, in the schooner "Academy," which had been purchased and rechristened for the purpose. The scientific staff of the expedition consisted of eight young men. Mr. R. H. Beck, who has had more experience in these islands than any other collector—this being his fourth expedition to them—was in charge. Mr. Alban Stewart went as botanist; Mr. W. H. Ochsner, as geologist; Mr. F. X. Williams, as entomologist; while Mr. E. W. Gifford and Mr. J. S. Hunter were to study and collect the birds, and my assistant, Mr. J. R. Slevin, with the aid of Mr. E. S. King, was to care for the reptiles.

Having made brief stops at various islands near the coast of Lower California, as well as at San Benedicto, Socorro, Clipperton, and Cocos islands, the party reached the Galapagos Archipelago and landed upon Hood Island, September 24, 1905. During the months which followed, the most arduous collecting was vigorously carried on in all the islands of the group, many of the larger being visited several times, and on September 25, 1906, after a full year of work, the "Academy" left Culpepper Island and set sail for San Francisco, where she arrived in safety Thanksgiving day, November 29, 1906.

This exploration met with far greater success than I had anticipated. Tortoises, or their remains, were found for the first time on Barrington, Jervis, and Narborough islands, and on Cowley Mountain, Albemarle Island. They were also found still living in all the localities from which they had ever been recorded except Charles Island, where they appear, as on Barrington, to be really extinct. Only on Duncan Island and the southern portion of Albemarle were they encountered in considerable numbers, and in the latter region they are being rapidly reduced by the raids of the natives who kill them for meat and oil.

It was Captain Porter who first called attention to the fact that each of the tortoise-bearing islands of the archipelago had its own peculiar race or species. With the exception of Albemarle, no island has more than one kind of tortoise. Now there is evidence that Albemarle, the largest island of the

group, has been formed by the union of several smaller islands, corresponding, probably, to its five great volcanoes. Accordingly, we find on Albemarle five distinct races of tortoises, each of which, I believe, originated upon one of these constituent volcanoes prior to their union. If this view be correct, some of these races have since spread to other portions of Albemarle Island, but each race still is found either in greatest numbers or alone upon that portion of the island where it originated. Thus one finds at Bank's Bay, in the northern part of Albemarle, a kind of tortoise not found elsewhere. The region about Tagus Cove, in north-central Albemarle, has tortoises of but one race, which race, however, seems to occur also on the southern coast of Albemarle. The same is true of Iguana Cove, while on Vilamil Mountain and in the adjoining portions of the island is found still another race, which does not occur elsewhere. The Cowley Mountain tortoise seems nearly identical with that of Indefatigable Island; but this conclusion is based upon a single female specimen, not adult, and I believe that a good series of specimens would lead to a different result.

The present state of our knowledge indicates, then, that there once lived in the Galapagos Archipelago fourteen or fifteen distinct races of gigantic land tortoises, each occupying its own island, as follows:

| | ISLAND | PRESENT STATUS |
|---|---|---|
| 1. | Abingdon | Rare |
| 2. | James | Rare |
| 3. | Jervis | Very rare |
| 4. | Duncan | Fairly abundant |
| 5. | Indefatigable | Not rare |
| 6. | Barrington | Extinct |
| 7. | Chatham | Nearly extinct |
| 8. | Hood | Very rare |
| 9. | Charles | Extinct |
| 10. | Narborough | Very rare |
| 11. | Vilamil, Albemarle | Abundant |
| 12. | Iguana Cove, Albemarle | Numerous |
| 13. | Tagus Cove, Albemarle | Fairly numerous |
| 14. | Bank's Bay, Albemarle | Fairly numerous |
| 15. | Cowley Mt., Albemarle | Rare |

It now becomes necessary to consider what names are applicable to these various races.

# SYSTEMATIC ACCOUNT

## 1. Nomenclature

Eighteen names have been proposed for Galapagos tortoises, as follows:

| | DATE | NAME | AUTHORITY | LOCALITY |
|---|---|---|---|---|
| 1. | 1824— | *Testudo nigra* | Quoy & Gaimard | "California" |
| 2. | 1824— | *Testudo californiana* | Quoy & Gaimard | |
| 3. | 1827— | *Testudo elephantopus* | Harlan | Galapagos |
| 4. | 1835— | *Testudo nigrita* | Duméril & Bibron | No locality |
| 5. | 1855— | *Testudo planiceps* | Gray | No locality |
| 6. | 1875— | *Testudo ephippium* | Günther | No locality |
| 7. | 1875— | *Testudo microphyes* | Günther | No locality |
| 8. | 1875— | *Testudo vicina* | Günther | No locality |
| 9. | 1877— | *Testudo abingdonii* | Günther | Abingdon |
| 10. | 1889— | *Testudo galapagoensis* | Baur | Charles |
| 11. | 1889— | *Testudo güntheri* | Baur | No locality |
| 12. | 1901— | *Testudo becki* | Rothschild | North Albemarle |
| 13. | 1902— | *Testudo wallacei* | Rothschild | No locality |
| 14. | 1904— | *Testudo porteri* | Rothschild | Indefatigable |
| 15. | 1907— | *Testudo hoodensis* | Van Denburgh | Hood |
| 16. | 1907— | *Testudo darwini* | Van Denburgh | James |
| 17. | 1907— | *Testudo chathamensis* | Van Denburgh | Chatham |
| 18. | 1907— | *Testudo phantasticus* | Van Denburgh | Narborough |

Eight of these names are based upon specimens whose origin is definitely known. There can be no question as to the races to which these names apply. The other ten, however, were proposed, often with vague descriptions from examples which leave much to be desired in respect both to history and to condition. It will be necessary to consider each of these names in turn to determine, if possible, its proper use.

### 1. *Testudo nigra* Quoy & Gaimard. 1824

This name was applied by Quoy and Gaimard, in 1824, to a very young tortoise presented to M. de Freycinet by Captain Meek, of the "Boston Eagle," while the "Uranie" and "Physicien" were in the Sandwich Islands, and said to have come from California. Owing to the small size of this tortoise the differential characters are not developed. Rothschild, who recently examined the type in the Paris Museum, writes[1] that it "is a young tortoise with a carapace barely 10½ inches long, and so indifferently preserved that it is *absolutely* impos-

[1]Novitates Zool., IX, 1902, p. 618.

sible to say to what race it belongs. Dr. Albert Günther, who examined the specimen with me, is even more emphatic on this point than I am." The exact locality of origin being unknown, I think it impossible ever to decide which species it represents, and therefore follow Günther, Baur and Rothschild in ignoring the name *Testudo nigra.*

### 2. *Testudo californiana* Quoy & Gaimard. 1824

This name, also proposed by Quoy and Gaimard in 1824, evidently was based upon the specimen which they described as *Testudo nigra.* It is therefore a substitute name.

### 3. *Testudo elephantopus* Harlan. 1827

This name was first used by Dr. Richard Harlan in a paper published in the *Journal of the Academy of Natural Sciences of Philadelphia,* in 1827, and afterward reprinted in Harlan's *Medical and Physical Researches* (1835). The description was based upon a living specimen in the possession of Mr. Whitton Evans. Beyond the mere fact that it was from the Galapagos Islands, Dr. Harlan said nothing of the origin of this tortoise.

In 1874, Dr. Günther, recognizing the fact that Harlan's specimen belonged to one of the broad races, associated with the name *Testudo elephantopus* certain specimens of indefinite origin. The carapace which he figured is depressed, with somewhat elevated front, width over curve greater than length over curve, height to marginals low, and pectoral plates well developed.

In 1889, after having examined a specimen which he thought was the one described by Harlan, Dr. George Baur[2] stated his conclusion that the specimens which Dr. Günther had referred to *Testudo elephantopus* did not belong to the species represented by Harlan's type. It is probable that the specimen Baur examined is a South Albemarle tortoise of the *vicina* type, for Baur states that "a number of specimens collected by the 'Albatross' agree exactly with" this specimen "and the *T. vicina* of Günther."

[2]Am. Naturalist, Dec. 1889, p. 1043.

Later, Rothschild borrowed this specimen which Baur had examined and, having studied it, concluded[3] that it was not the same as Günther's *Testudo elephantopus,* and that it was identical with Günther's *Testudo vicina.* He, moreover, held that Günther's *Testudo elephantopus* was the same as Harlan's, and, a little later,[4] expressed the opinion that it came from Hood Island.

We have, therefore, to consider three questions:

1.—Is *T. elephantopus* from Hood Island?

2.—Is Günther's *T. elephantopus* the same as Harlan's?

3.—Is it possible to determine what race Harlan's specimen represented?

These I shall endeavor to answer in the order in which they are given.

1.—I think it may be stated postively that neither Harlan's nor Günther's *Testudo elephantopus* came from Hood Island. Both are of the broad form, in which the width over the curve exceeds the length over curve, while in the Hood Island race the curved length exceeds the curved width. There are also other points of difference.

2.—I feel equally positive that the specimen figured by Dr. Günther is not identical with Harlan's species. The chief points of distinction are: Günther's specimen has the height to marginals low, while, if one may judge from his plate, Harlan's specimen belonged to one of those races in which this measurement is great. Günther's specimen has the anterior portion of the carapace expanded, while in Harlan's there is at least an approach to the laterally compressed, "saddle-backed" form. Günther's specimen, moreover, has a greater straight width than Harlan's, and there are minor points which also lead to the conclusion that the two belong to different races. The identity of the specimen figured by Günther will be considered under the heading *Testudo güntheri* Baur.

3.—Inasmuch as Harlan did not know that there existed in the Galapagos Islands more than one kind of tortoise, his description is brief and couched in terms so general as to render

[3]Novitates Zool., IX, 1902, p. 448.
[4]*Loc. cit.,* p. 618.

it very difficult to determine positively from it which race his specimen represented. This being true, the fate of Harlan's specimen becomes of much interest, since only from it can we obtain the desired data. Unfortunately, there is little doubt that this specimen no longer exists. Baur,[5] it is true, mentions examining Harlan's original specimen in the Philadelphia Academy of Natural Sciences, but the specimen to which he refers does not agree with the description or measurements given by Harlan, and, indeed, has never been regarded as Harlan's type by the authorities of the Academy. At my request, Dr. Arthur E. Brown has been kind enough to look the matter up, and, while the Philadelphia Academy has no complete records of its museum in those early days, he has found in an early volume of the *Journal,* in the list of donations in February, 1827, mention of a *"Testudo elephantopus* from Richard Harlan, M. D." As this was only five months after Harlan's paper was read, it seems fair to presume that the specimen presented was the one which had served as the basis of his description. With Mr. Witmer Stone, Dr. Brown then "made a careful search through a lot of odds and ends of old material, with the result that we found the cleaned leg bones of one side, and a part of the legs of the other side with dried skin still on them, of a *Testudo* about the size of Harlan's type, with an index number (366) making it almost certain that it came from Harlan." Dr. Brown says, "In the opinion of both Mr. Stone and myself, these fragments are probably all that is left of the type of *T. elephantopus,* which had apparently been mounted, but long ago became dismembered, leaving only these scraps which do not bear any of the specific characters."

It therefore seems fairly certain that no one ever will know from the specimen itself what Harlan's *Testudo elephantopus* really was, and that any opinion must be based upon the meager data to be derived from Harlan's original description and plate. I have already stated that I believe these to be scarcely adequate. The points of value in this connection are: that it was a young individual, probably a female, with elevated central areas and concentric ridges on the plates, pectoral plates meeting extensively on the median line—therefore not from Chatham Island; breadth over curve (22.6) greater than length over curve

[5]Am. Naturalist, Dec. 1889, p. 1043.

(21.6)—therefore, considering its size,[6] not from Hood, Abingdon, Bank's Bay, Narborough, Tagus Cove, James, Chatham, or Duncan; vertical diameter nine inches; lateral diameter fourteen inches; marginals reflected upward anteriorly and over limbs; height to marginals apparently great—therefore not from Chatham, Tagus Cove, Bank's Bay, nor Narborough; front of carapace elevated—therefore not from Indefatigable Island nor Cowley Mountain, Albemarle.

In the foregoing list we have excluded most of the races of the Galapagos Archipelago. Of all the localities where tortoises ever had been found in the archipelago up to the date of the visit of the present expedition, there remain to be considered only two—Charles Island and southern Albemarle.[7] I doubt if it be possible to decide with certainty from either the description or the plate whether Harlan's type came from Charles Island rather than from Albemarle; but there is other evidence which throws some light upon the question. First, there is the circumstance that most of the early voyagers secured their tortoise from Charles, James, and Hood islands. Second, Porter stated in his journal that the tortoises of Hood Island were similar in appearance to those of Charles Island, the form of the shell being elongate and turned up forward in the manner of a Spanish saddle. Third, Harlan's plate strikingly resembles my specimens from Hood Island, although his measurements show that he had a different and much broader species. Fourth, the few specimens in collections which can be pretty definitely traced to Charles Island agree with Harlan's specimen in having the length over the curve less than the breadth over the curve.

I hold, therefore, that Harlan's specimen came from Charles Island, although we cannot positively prove this to have been the case. This being true, the name *Testudo elephantopus* cannot be used for the distinct race to which Günther applied it.[8] Some might think it best not to use the term at all, sub-

[6]The young are narrower than the adults, so that this statement is true, although in some of the races here enumerated adult individuals may have the curved width greater than the curved length.

[7]The shape of the carapace of the tortoise found on Jervis Island is quite different from Harlan's plate of *T. elephantopus*, and although the carapace of the Barrington Island tortoise is unknown, I think that these islands may safely be ignored as possible places of origin of Harlan's specimen, for the reason that tortoises had never been found upon them by any of the earlier explorers.

[8]See *Testudo güntheri infra.*

stituting for it Baur's later but more definite name *Testudo galapagoensis;* but to me the evidence seems sufficiently conclusive to justify the retention of Harlan's excellent name for the Charles Island tortoise.

### 4. *Testudo nigrita* Duméril & Bibron. 1835

Regarding this name I quote from Günther:

"No doubt can possibly be entertained as regards the correct application of this name to the species which I am about to describe. It had been given by Duméril and Bibron (Erpétol. Génér. II, p. 80) to two examples, of which the smaller, very young one, is in the Paris Museum, whilst the larger, but also of young age, is the property of the Royal College of Surgeons. Bibron's description is almost entirely drawn up from the latter specimen, which, therefore, must be regarded as the type."

Günther associated with this specimen a large carapace, without plastron, belonging to the British Museum. Nothing is known regarding the origin of these specimens. Günther figured both the type and large carapace, and states that both probably were males. Study of the plates and measurements given has developed no reason for doubting the correctness of Günther's conclusion that these two specimens represent the same species of tortoise.

Since the original specimens of Duméril and Bibron represent animals too young to have developed distinctive specific characters, the attempt to determine to which particular race the name *Testudo nigrita* should apply must rest upon the adult specimen with which Günther later associated it. This specimen has the following measurements:

| | | | |
|---|---|---|---|
| Straight length | 39.25 | inches | |
| Straight width | 33.50 | " | 85% |
| Length over curve | 50.75 | " | 129% |
| Width over curve | 52.25 | " | 133% |
| Width at 2-3d marginals | 21. | " | 53% |

Unfortunately this specimen is incomplete. There remains only the upper shell. However, the circular outline and the great height of the dome-shaped carapace are so characteristic that I have no hesitation in expressing the opinion that it

must represent one of two very similar races. These races are the one characteristic of Indefatigable Island, and that found upon Cowley Mountain in central Albemarle. The question then arises, to which of these can the name *Testudo nigrita* be applied.

The differences between the Cowley Mountain tortoise and those of Indefatigable are very slight. Indeed, there is no measurement of the former which cannot be duplicated in some specimen from Indefatigable Island. However, the curved length and the width between second and third marginals are less, and the middle height and difference between curved length and curved width are greater, than is usual in the Indefatigable tortoise. If we take, then, the percentages of these measurements and add the first two (the curved length *plus* width at second to third marginals), and subtract from this the sum of the other two measurements, we have as the result 111, a figure which always is exceeded when we combine in the same way the measurements of any Indefatigable tortoise.

The fact that I have only one tortoise from Cowley Mountain, of course, renders unsafe the conclusion that we have here two distinct races; but, on the other hand, the fact that my 23 specimens from Indefatigable all are alike in this difference from the Cowley specimen gives that conclusion considerable weight.

Unfortunately, we cannot know the middle height of Günther's specimen, but the other measurements enable us to say that it agreed with the Indefatigable tortoises and was unlike the Cowley specimen, unless it had a middle height greater than in any other specimen of any race of Galapagos tortoise.

We seem justified, then, in saying that Günther's *Testudo nigrita* agrees with the Indefatigable tortoise. When, in addition, it is recalled that the early tortoise-hunters frequented Indefatigable Island, but rarely visited Albemarle, I can see no good reason for doubting that this specimen really came from Indefatigable, and that it belongs to the race which recently has been called *Testudo porteri*. However, since conclusions based upon an imperfect specimen of unknown origin must always be open to some question, and especially since this specimen is not the original type upon which the name was

established, it seems best to pass over the name *Testudo nigrita,* and to use for the Indefatigable Island race the name *Testudo porteri.*

### 5. *Testudo planiceps* Gray. 1855

This name was established for a skull of unknown origin. Dr. Günther regarded it as representing the race previously named *Testudo nigrita.* The name has since appeared only in the synonymy of that tortoise.

### 6. *Testudo ephippium* Günther. 1875

The original description of this species was published by Dr. Günther, in 1875, in the *Philosophical Transactions.* It was based upon a single specimen of unknown origin belonging to the Edinburgh Museum of Science and Arts. Because Porter's remarks on the tortoises of Charles Island applied so well to this specimen, Dr. Günther was originally[1] of the opinion that it represented the Charles Island race, but he later[2] referred it to Indefatigable Island.

Dr. George Baur,[3] in 1889, was convinced that *Testudo ephippium* represented the Abingdon Island race. This was chiefly because of some notes which Dr. Baur found in an edition of Captain Basil Hall's *Extracts from a Journal.*[4] Captain Hall visited the Galapagos Islands in January, 1822. Abingdon was the only island upon which he landed. Speaking of the tortoises, Captain Hall says: "We took some on board, which lived for many months, but none of them survived the cold weather off Cape Horn. I preserved one in a cask of spirits, and it may now be seen in the Museum of the College at Edinburgh; it is about the medium size."

As Dr. Günther remarks,[5] "this discovery received further confirmation when Dr. Traquair, on renewing his inquiries, found in the records of the old College Museum an entry of a 'Large Turtle from South Sea—Captain Basil Hall.' Un-

[1]Trans. Royal Soc. Lond. 1875, pp. 260, 271.

[2]Gigantic Land Tortoises Brit. Mus., 1877, p. 11.

[3]Am. Nat., XXIII, 1889, pp. 1041-1042.

[4]Hall, Extracts from a Journal written on the Coasts of Chili, Peru, and Mexico, in the Years 1820, 1821, 1822. Part II. London, 1840. (Original Edition, Edinburgh, 1824.)

[5]Novitates Zool., III, No. 4, 1896, p. 333.

fortunately no mark or label is attached to the specimen by which its identification could have been placed beyond question, so that, as Dr. Traquair says at the end of a letter to Dr. Baur, "we have no absolute certainty as to whether our *Testudo ephippium* is the specimen from the South Sea presented by Captain Basil Hall or not."

Recently,[6] Dr. Günther has compared the type of his *T. ephippium* directly with three specimens of the Abingdon tortoise and four specimens from Duncan Island. He finds that the agreement of the Duncan Island specimens with the type of *T. ephippium* is perfect, while marked differences exist between that specimen and those from Abingdon Island.

After careful study of his descriptions, measurements, and plates, in connection with my large series of specimens from Duncan Island, I see no reason to doubt the correctness of Günther's conclusion that the name *Testudo ephippium* may properly be applied to the Duncan Island tortoise.

### 7. *Testudo microphyes* Günther. 1875

*Testudo microphyes* was first described by Günther, in 1875, from a small adult individual which he then thought was a male, but which he later concluded was a female. This specimen was without definite locality. Günther at first[7] thought it represented the Hood Island race, but later[8] identified it with specimens from Tagus Cove, Albemarle Island. The merging of the anterior two marginals of each side into a single plate is probably, as Günther remarked, only an individual variation.

Some measurements of the type specimen in the British Museum were made for me, as follows:

| | | | |
|---|---|---|---|
| Straight length | 21.3 | inches | 100% |
| Straight width | 15.85 | " | 74.4% |
| Length over curve | 26.45 | " | 124% |
| Width over curve | 26.5 | " | 124% |
| Width at 2-3d marginals | 12.4 | " | 58.2% |
| Middle height | 10.1 | " | 47.4% |
| Front height | 6.8 | " | 32% |
| Height to marginals | .9 | " | 4.2% |
| Length of plastron | 17.6 | " | 82.6% |

[6]Novitates Zool., III, No. 4, 1896, pp. 329-334.
[7]Trans. Royal Soc. Lond., 1875, pp. 260, 275.
[8]Gigantic Land Tortoises Brit. Mus., 1877, p. 78.

These measurements, as well as Günther's figures, show clearly that the height to marginals is very low in the type specimen. This being true, it must have come from one of three localities, if it represents any of the known non-saddle-backed races. These localities are Chatham, Tagus Cove, and southern Albemarle. The general shape, the great breadth over curve, and the development of the pectoral plates, indicate that it did not originate in Chatham Island. It must, therefore, have come from Albemarle Island. Since there occur in southern Albemarle (Cape Rose) tortoises which I have been unable to distinguish from those of Tagus Cove, any attempt to determine more definitely the place of origin of Günther's type seems needless. If, then, we are right in considering that the tortoises from Cape Rose are identical with those of Tagus Cove, there are two Albemarle races having the general characteristics of the type of *Testudo microphyes*. These are the race found at Tagus Cove (and Cape Rose) and the smooth flat-backed race of southeastern Albemarle, for which I employ the name *Testudo güntheri* Baur. Lacking as I do any females from Tagus Cove, I am unable, from Günther's figures and descriptions, or from the measurements at hand, to indicate any very satisfactory points of distinction between the type of *T. microphyes* and those tortoises from southeastern Albemarle. My opinion, however, is that Günther's type belongs with the Tagus Cove specimens, and my "key" so refers it.

Until it can be shown that his type specimen differs from the specimens taken at Tagus Cove, Günther's later association of the name *Testudo microphyes* with this race should be followed. I therefore employ the name *Testudo microphyes* for the tortoises from Tagus Cove, Albemarle, and for a few specimens taken near Cape Rose on the southern coast of Albemarle Island.

### 8. *Testudo vicina* Günther. 1875

This name was proposed by Günther[1] for the carapace and skeleton of a large male of unknown origin. Commander Cookson having found at Iguana Cove, Albemarle, a tortoise

[1]Trans. Royal Soc. Lond. 1875, p. 277.

of different shape and general appearance from those captured near Tagus Cove,[2] Günther[3] thought it very probable that Albemarle was inhabited by at least two distinct races. He compared the skull of the type specimen of his *Testudo vicina* with a skull[4] brought by Commander Cookson from Iguana Cove, and, finding them identical, concluded that *Testudo vicina* was the race native to southwestern Albemarle. Many years later, Rothschild obtained specimens from Iguana Cove, and confirmed this opinion, which since then has been accepted quite generally.

The discovery of several races which were not known to Günther, Baur, or Rothschild, makes it necessary to reopen the question, and to consider whether Günther's specimen may not belong to one of the latter rather than to the race with which it has been associated. I find, however, that the only tortoises, aside from South Albemarle specimens, bearing any great resemblance to Günther's type are those from James and Jervis islands; but since I have as yet been unable to find any differences sufficient to enable me to distinguish the single Jervis specimen from the Iguana Cove tortoises, we need consider, in the present connection, only those from James Island.

Günther's type specimen has the following dimensions,[5] in inches and percentages of the straight length:

| | | | |
|---|---|---|---|
| Straight length | 32.9 | inches | 100% |
| Straight width | 25 | " | 76% |
| Length over curve | 41 | " | 125% |
| Width over curve | 40 | " | 122% |
| Width at 2-3d marginals | 16.75 | " | 51% |
| Middle height | 16 | " | 49% |
| Front height | 14.2 | " | 41% |
| Height to marginals | 2.75 | " | 8% |
| Length of plastron | 25.5 | " | 77% |

These measurements, like Günther's plate, show that the specimen has not the high convex back and other characteristics of the James Island race, but that it agrees very closely with specimens from Iguana Cove. I can see no good reason for not regarding it as identical with specimens from the latter locality, and, therefore, shall follow all recent authors in

[2]Cookson, Proc. Zool. Soc. Lond. 1876, p. 524.

[3]Gigantic Land Tortoises Brit. Mus., 1877, p. 73.

[4]The single living specimen was lost before reaching England.

[5]These measurements have been in part taken for me with the kind permission of Dr. Boulenger, and in part are derived from Gunther's writings.

the use of the name *Testudo vicina* Günther for the race found at Iguana Cove and throughout southern Albemarle.

### 9. *Testudo galapagoensis* Baur. 1889

In 1833, Commander John Downes visited the Galapagos Islands in the United States Frigate "Potomac."[6] Charles was the only island on which he landed. The visit there extended from August 31 to September 10. "A large number of the crew were daily on shore after terrapin, and frequently exposed throughout the day to a hot sun, with these immense animals on their backs, traveling over the broken lava." The "Potomac" returned to Boston, May 23, 1834. In the following month, Captain John Downes, of the "Potomac," presented to the Boston Society of Natural History two living gigantic Galapagos tortoises, weighing nearly three hundred pounds each.[7] There would seem to be little room for doubt that these specimens originated in Charles Island.

These tortoises, a male and a female, served as material for a paper, by Dr. J. B. Jackson, entitled *Anatomical Description of the Galapagos Tortoise,*[8] published in 1837. Jackson regarded them as identical with Harlan's *Testudo elephantopus,* it being generally thought that all Galapagos tortoises were of one species.

Of these two specimens, it appears that only the male is still in the collection of the Boston Society of Natural History. The measurements given by Jackson prove it to be the specimen described by him. What became of the female is not known.

In his article published in the *American Naturalist* for December, 1889, Dr. Baur, having compared the skull of the specimen remaining in the collection of the Boston Society with that of a tortoise belonging to the Philadelphia Academy of Sciences, which he mistook for Harlan's original specimen,[9] stated that the two were specifically distinct. Without stating any of the points of difference, Dr. Baur named the

[6]Reynolds, Voyage of the United States Frigate Potomac, 1835, pp. 464-73, 547; *c. f.* Baur, Am. Nat., XXIII, 1889, p. 1039.

[7]Journal Boston Soc. Nat. Hist., I, 1834-37, p. 521.

[8]Tom. cit., pp. 443-64, pls. X, XI.

[9]Regarding the identity of this specimen see remarks under *Testudo elephantopus* Harlan, 1827, p. 245.

Charles Island specimen *Testudo galapagoensis*. Were it not for the fact that Baur specifically refers to this particular specimen in the Museum of the Boston Society of Natural History, this name might be regarded as a *nomen nudum*. It remained for Dr. Günther, in 1902,[10] to point out characters distinguishing *Testudo galapagoensis* from the other races known to him.

To me, the evidence that the type of *Testudo galapagoensis* came originally from Charles Island, although circumstantial, is convincing. Also, I believe that it represents a race distinct from any known from another locality. While Baur was right in his conclusion that it differed from the specimen which he thought was Harlan's type of *T. elephantopus,* he was wrong in so regarding the latter specimen, which, it seems, is merely a young *Testudo vicina* and not Harlan's specimen at all. Therefore, it never has been shown that Jackson's specimens, one of which became the type of Baur's *Testudo galapagoensis,* were not the same as Harlan's *T. elephantopus*. I have already[12] given my reasons for thinking that Harlan's specimen represented the Charles Island race. If I am right in this view, Harlan's *Testudo elephantopus* and Baur's *Testudo galapagoensis* are synonyms. The former is much the older term.

### 10. *Testudo güntheri* Baur. 1889

In his article on Gigantic Land Tortoises of the Galapagos Islands,[13] published in 1889, Dr. George Baur proposed the name *Testudo güntheri* for the species described by Dr. Günther as *Testudo elephantopus* Harlan. The specimen figured by Dr. Günther may be regarded as the type. This specimen, as I have stated in discussing *T. elephantopus,* is of indefinite origin. The carapace is depressed, with somewhat elevated front; width over curve greater than length over curve; height to marginals low; and pectoral plates well-developed. In shape, it resembles the Chatham Island tortoise, but differs in the greater breadth over curve and in the development of the pectoral plates. It, seemingly, is identical with the smooth,

[10]Novitates Zool., ix, July, 1902, pp. 184-92, pls. xvi-xxi.
[12]p. 247 *ante*.
[13]Baur, Am. Naturalist, xxiii, Dec. 1889, p. 1044.

depressed race found in southeastern Albemarle, in which the height to marginals is low. *Testudo güntheri,*[14] therefore, is available as a name for that tortoise.

### 11. *Testudo wallacei* Rothschild. 1902

Rothschild proposed this name for a carapace of unknown origin. He says it belongs to the section including *T. vicina.* It is not saddle-shaped, but in other respects seems nearer to *Testudo galapagoensis* than to any other race. It differs from *T. galapagoensis* in its greater depth, much narrower anterior portion of carapace, convex marginal plates, and in being strongly declivous in front. The total length in a straight line is 32.25 inches. From the fact that between the years 1800 and 1835 most of the giant tortoises were got on James and Chatham islands, and that Captain Porter says the James Island ones were round, Rothschild was of the opinion that this carapace represented the Chatham Island species.

It would be quite impossible, I think, from this brief description alone to form an opinion of any value as to the identity of *Testudo wallacei.* Fortunately, however, I now have before me a photograph of Rothschild's specimen. Since Mr. Rothschild's article appeared we have received tortoises from both Chatham and James islands. *T. wallacei* is very different from the Chatham Island race. The only tortoises which Mr. Rothschild's specimen at all resembles are those of Charles, James, and Jervis islands, and one race of southern Albemarle. Rothschild himself has given reasons for regarding it as distinct from the specimens which are believed to have come from Charles Island. We need consider, then, only its relationship to the tortoises of James, Jervis and southern Albemarle.

The James Island tortoise is one of the races which may be considered as intermediate between the saddle-backed and non-saddle-backed groups. It is narrow, with a long plastron; and is high in front, with a still higher, somewhat dome-shaped, back. The Jervis and Iguana Cove tortoises have more horizontal backs sloping down anteriorly. The curved length

[14]Dr. Hans Gadow (Trans. Zool. Soc. Lond. 1894, p. 320) has proposed the name *Testudo güntheri* for certain fragmentary specimens from Mauritius. This term being preoccupied by Baur's application of it to a Galapagos tortoise, Dr. Gadow's species may be called *Testudo gadowi.*

is less, the straight width is usually greater, the plastron shorter.

In the Iguana Cove tortoises the curved width averages greater than the curved length, while in the James and Jervis tortoises the reverse is true.

There is current in the islands a rumor, which I have been unable to substantiate, that the tortoises on Jervis Island were introduced there by Dr. Baur. If this rumor is founded upon fact, the tortoises must have originated in southern Albemarle, and are, of course, identical with the *T. vicina* of that region. Certainly the Academy's specimen from Jervis has many points of resemblance to those from Iguana Cove. The curved length is greater, but I am unable to point out other definite points of distinction; although one gets the impression that differences exist, and would probably become evident, had one a series of specimens to compare. All this being true, it seems best, pending further information, to regard the Jervis Island tortoise as native to, and characteristic of, that island. I do not, however, feel justified in giving it a new name.

Rothschild gives only the straight length of his type of *T. wallacei,* and without other measurements it is hazardous to attempt to say which form it represents. However, the photograph before me shows a flat-backed shell which differs in many respects from my James Island specimens, while it seems to agree much more closely with the Jervis Island tortoise and the *T. vicina* from southern Albemarle. Rothschild had specimens of *T. vicina* with which to compare his *T. wallacei,* and evidently thought them distinct, although he says they belong to the same section. This leaves only the Jervis tortoise. I confess it is with a certain lack of confidence that I have concluded to use the name *T. wallacei* for this Jervis Island tortoise. Nevertheless it seems the best way out of two difficulties.

Having thus considered these questions of nomenclature we may now return to our list of races and apply to them the following names:

1. Abingdon ..... *T. abingdoni* Günther.
2. James ..... *T. darwini* Van Denburgh.
3. Jervis ..... *T. wallacei* Rothschild.
4. Duncan ..... *T. ephippium* Günther.
5. Indefatigable ..... *T. porteri* Rothschild.
6. Barrington ..... *T. sp.*
7. Chatham ..... *T. chathamensis* Van Denburgh.
8. Hood ..... *T. hoodensis* Van Denburgh.
9. Charles ..... *T. elephantopus* Harlan.
10. Narborough ..... *T. phantastica* Van Denburgh.
11. Vilamil, Albemarle ..... *T. güntheri* Baur.
12. Iguana Cove, Albemarle ..... *T. vicina* Günther.
13. Tagus Cove, Albemarle ..... *T. microphyes* Günther.
14. Bank's Bay, Albemarle ..... *T. becki* Rothschild.
15. Cowley Mountain, Albemarle..... *T. sp.*

## 2. DESCRIPTION.

It next becomes necessary to investigate the differences which distinguish these races of land tortoises one from another, to endeavor to find the limits of their variation, and to point out those characters which are available for their classification. This investigation we may divide into a consideration of external characters and an examination for osteological differences. The external characters may be divided into those of the shell, and those of the soft parts—the head, neck, limbs, and tail.

The Shell—Is covered with horny plates which do not differ in number,[1] but which vary in outline according to the shape of the bony shell. In young tortoises these plates bear striations corresponding to the lines of growth. Older individuals become smoother, but in certain races this tendency seems to be developed more strongly than in others. The oldest individuals of almost all races lose these striations. In certain races, the central portions of the vertebral and costal plates are elevated much more than in others. There are also marked differences in the lateral outline of the marginal plates. The upper border of the eighth marginal plate in *Testudo abingdoni* is much shorter than in any other race. In the Duncan Island tortoises one finds an occasional specimen with the pectoral plates reduced in size so that they do not meet on the median line. This tendency becomes more constant in *T. chathamensis*. It is unknown in any of the other races.

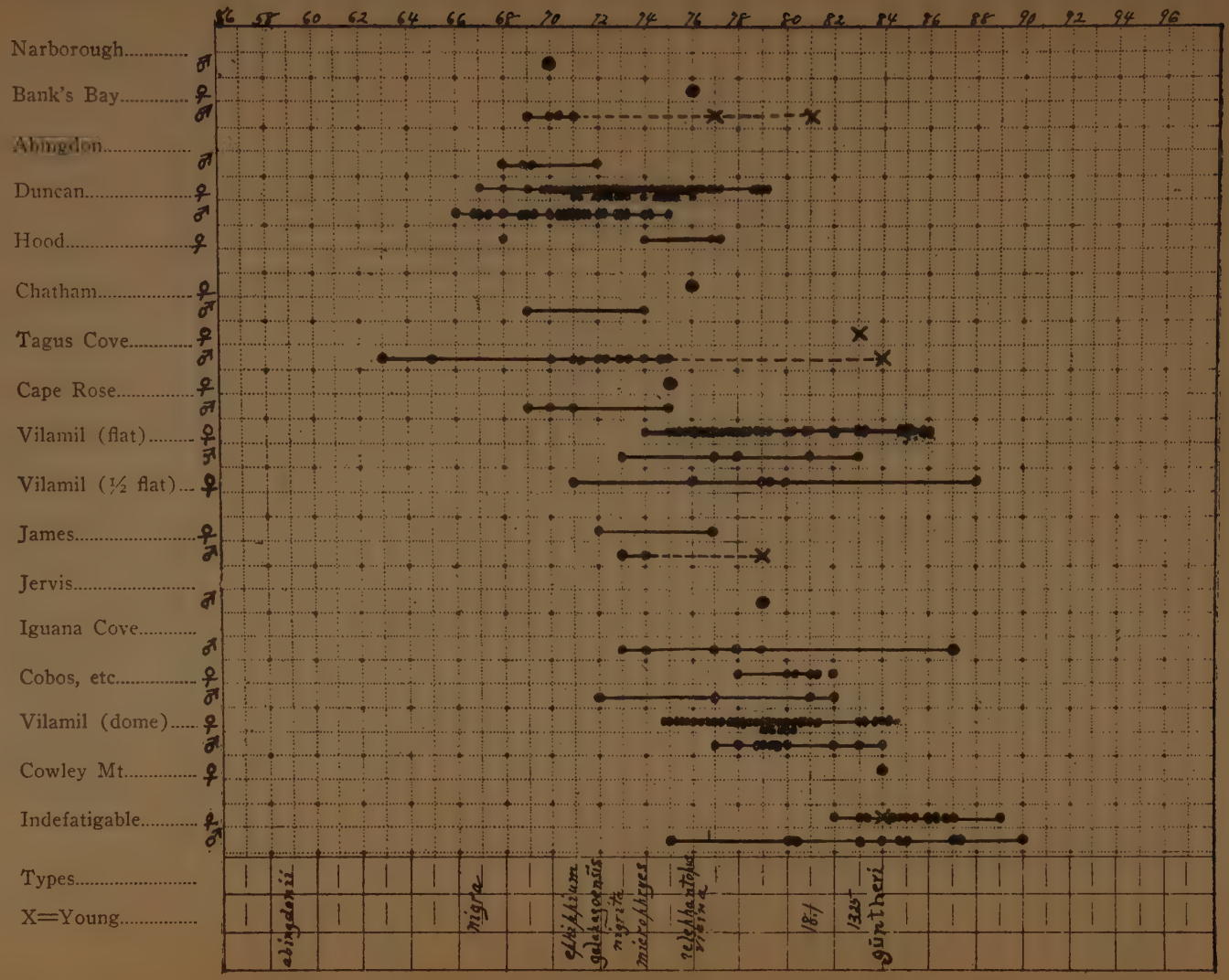
[1]Except as individual variations. See *T. ephippium* and *T. microphyes*.

In certain specimens from Vilamil (*T. güntheri*) one notes a curiously pitted surface on some of the plates, as though they were diseased. It is due to unequal shedding of the layers of the horny plates. Why it should be confined to this region, I cannot explain. Differences in color are very slight, but one specimen shows on one plate a single diagonal clear yellow ray, probably due to the absence of pigment cells at one point of growth.

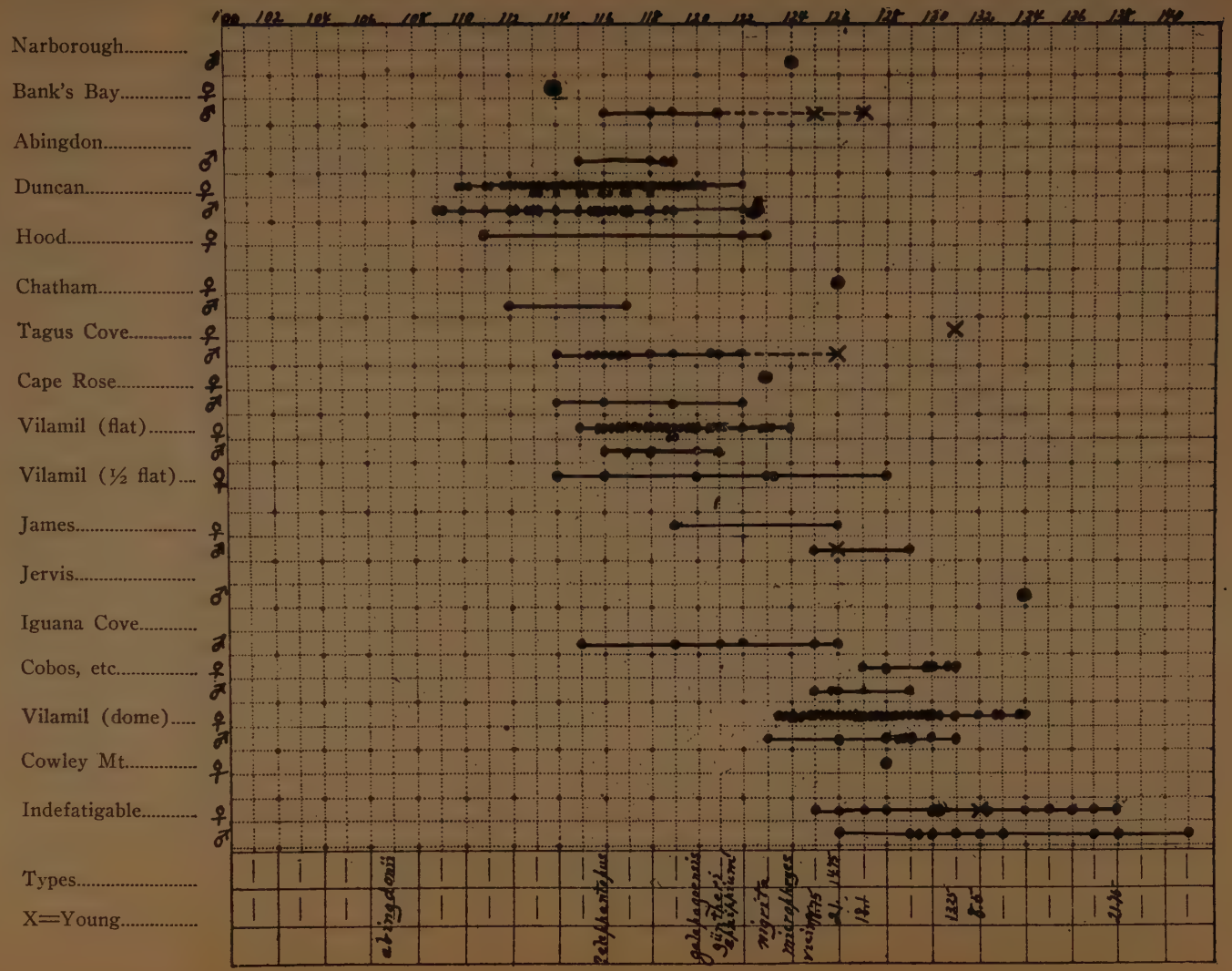
When one sees side by side tortoises from several islands, the differences which are most evident are those in the shape of the shell. But, while these differences are noticeable and real, they are subject to so much variation that their formulation is most difficult, not to say confusing. In order to avoid hopeless indefiniteness it is necessary to devise some means of expressing and comparing upon paper these variations in shape. It was found that this could best be done by taking numerous measurements of each tortoise and reducing all these measurements to percentages of the (straight) length of the tortoise In this way, the measurements of tortoises of all sizes may be directly compared. The tortoise is placed upon a level board or table in such a position that as nearly as possible it rests naturally upon the entire length of the plastral bridge of each side. With the tortoise in this position, the straight length is the distance between verticals erected at the nuchal notch and at the posterior border of the supracaudal plate. The straight width is the distance between verticals erected at the sides of the tortoise opposite the line of meeting of the second and third costal plates. The curved length is measured with a tape-measure over the midvertebral line from the nuchal notch to the posterior edge of the supracaudal plate. The curved width is taken from the bend in the marginal plates up along the line of meeting of the second and third costals, across the middle of the third vertebral, down between the second and third costals, to the line of bending of the marginals. The width second-to-third-marginals is the straight width at the level of the lateral margins of the sutures between the second and third marginal plates of each side. The middle height is the vertical distance between the board or table and the middle of the third vertebral plate, and is taken with a square and spirit-level. The front height is taken in the

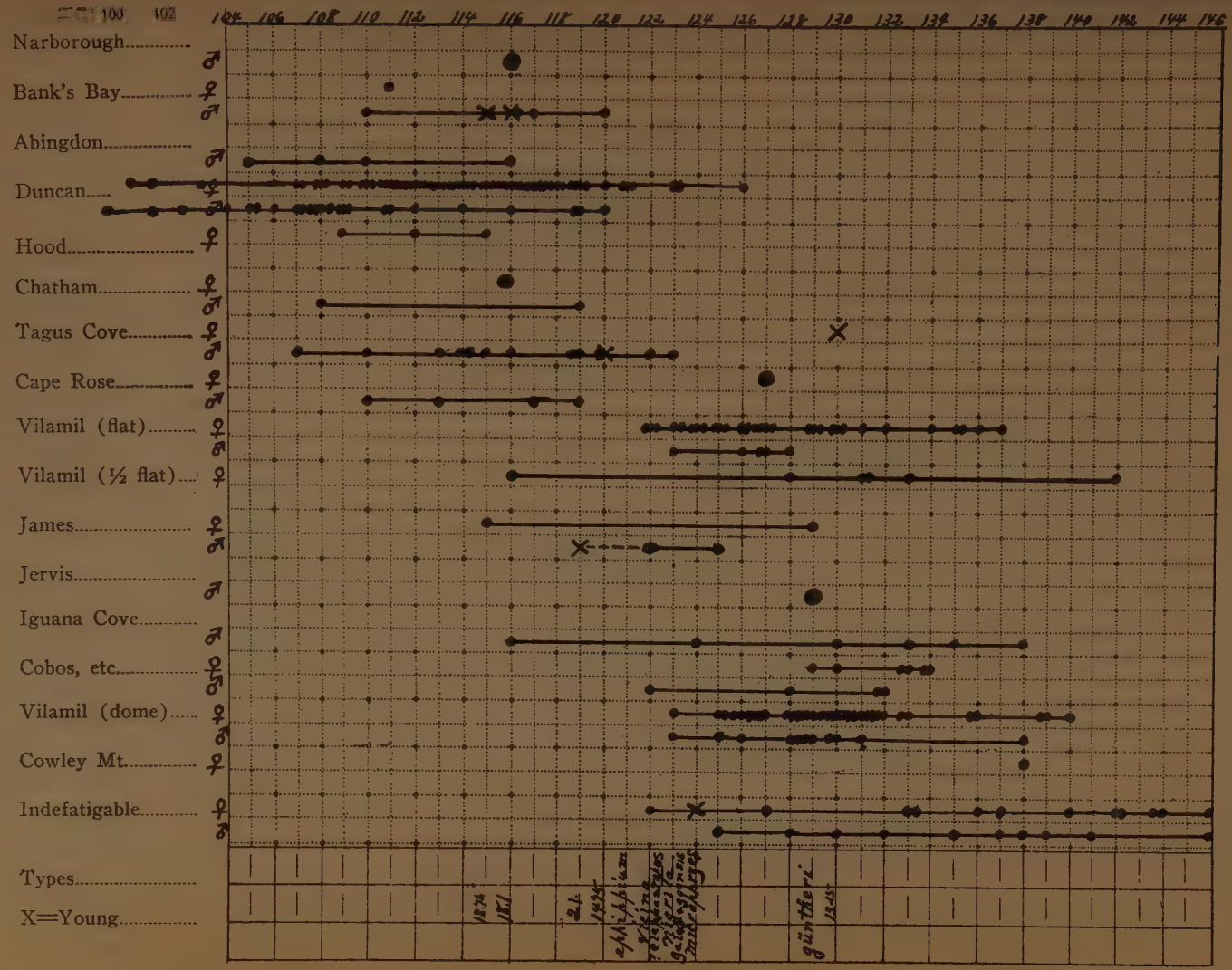
same manner at the nuchal notch. The height to marginals is the vertical distance from the table to the lower border of the marginal plates at about the middle of the plastral bridge. The plastron is measured with a tape along the median line—the tape is not pushed into plastral depressions, and when the plastron is notched the projections are not measured.

The actual measurements of the tortoises in the collection of the Academy will be given under each species. For purposes of comparison I have made charts showing each dimension as found in all the races represented. The males and females are charted on separate lines. Each medium-sized or adult specimen is represented by a dot, while the young are indicated by crosses. Certain combinations of these measurements are also charted.




Straight Width.


Narborough
Bank's Bay
Abingdon
Duncan
Hood
Chatham
Tagus Cove
Cape Rose
Vilamil (flat)
Vilamil (½ flat)
James
Jervis
Iguana Cove
Cobos, etc.
Vilamil (dome)
Cowley Mt.
Indefatigable
Types
X=Young
Length Over Curve.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Narborough
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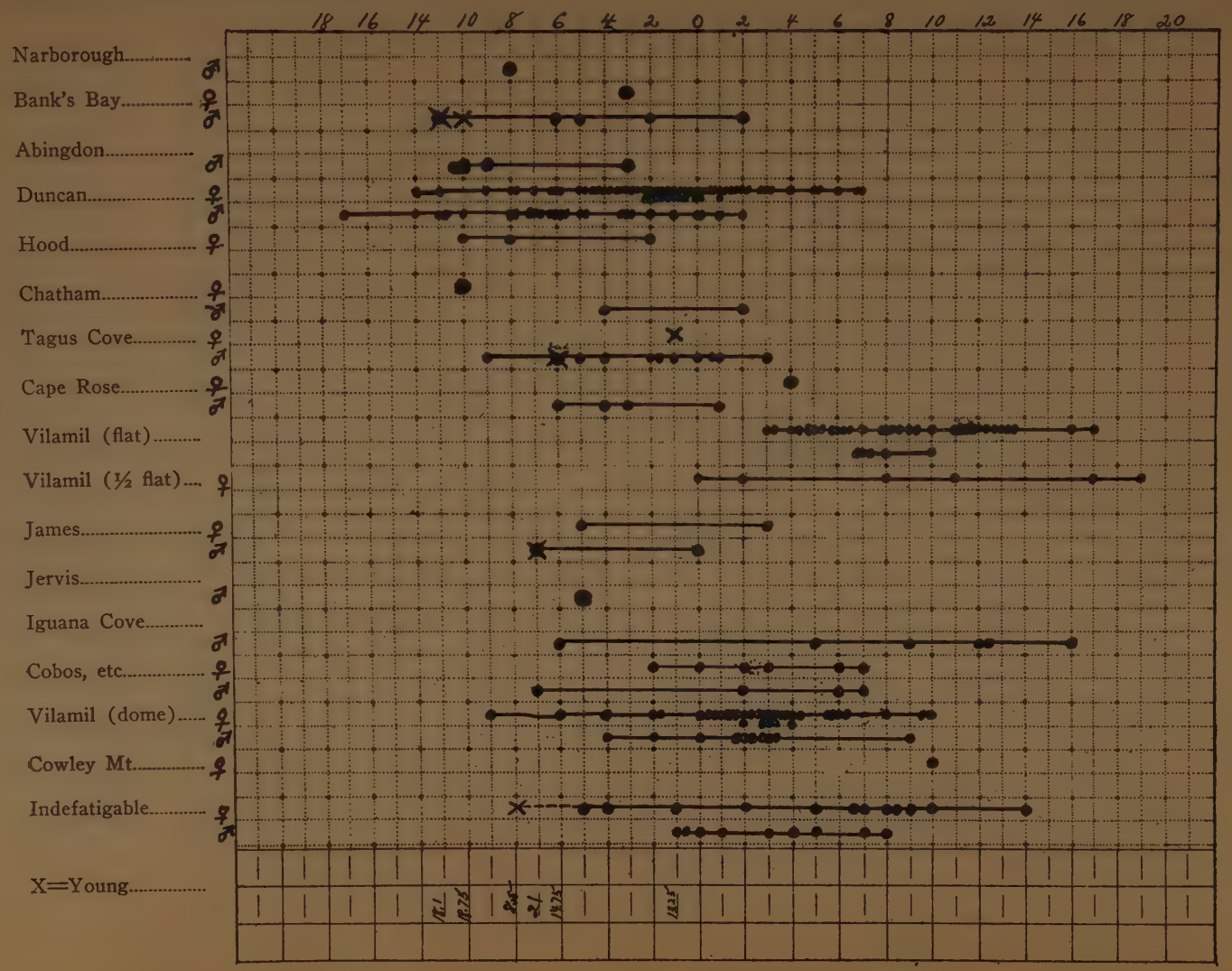
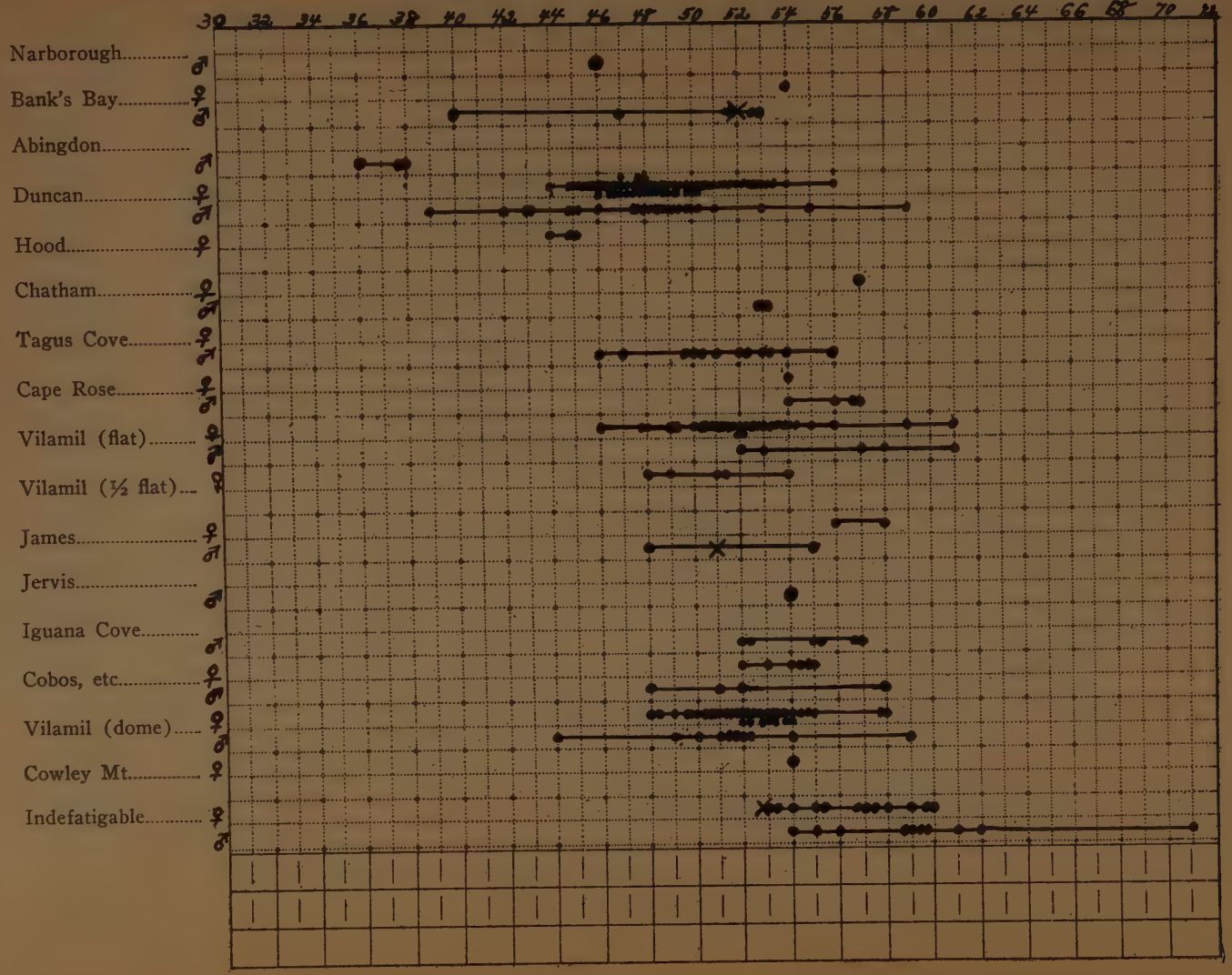
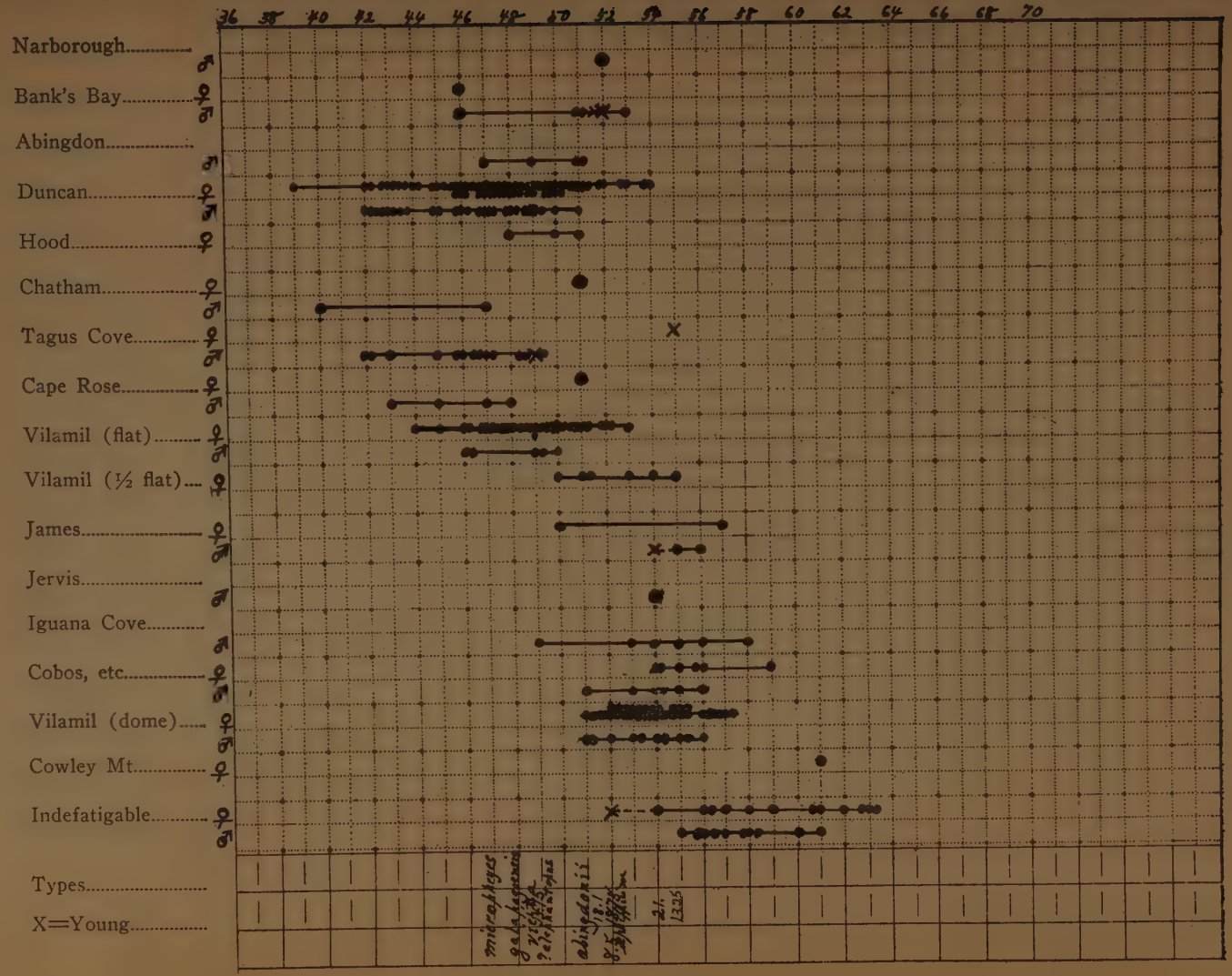
Vilamil (flat)
Vilamil (½ flat)
James
Jervis
Iguana Cove
Cobos, etc.
Vilamil (dome)
Cowley Mt.
Indefatigable
Types
X=Young
Curved Width.

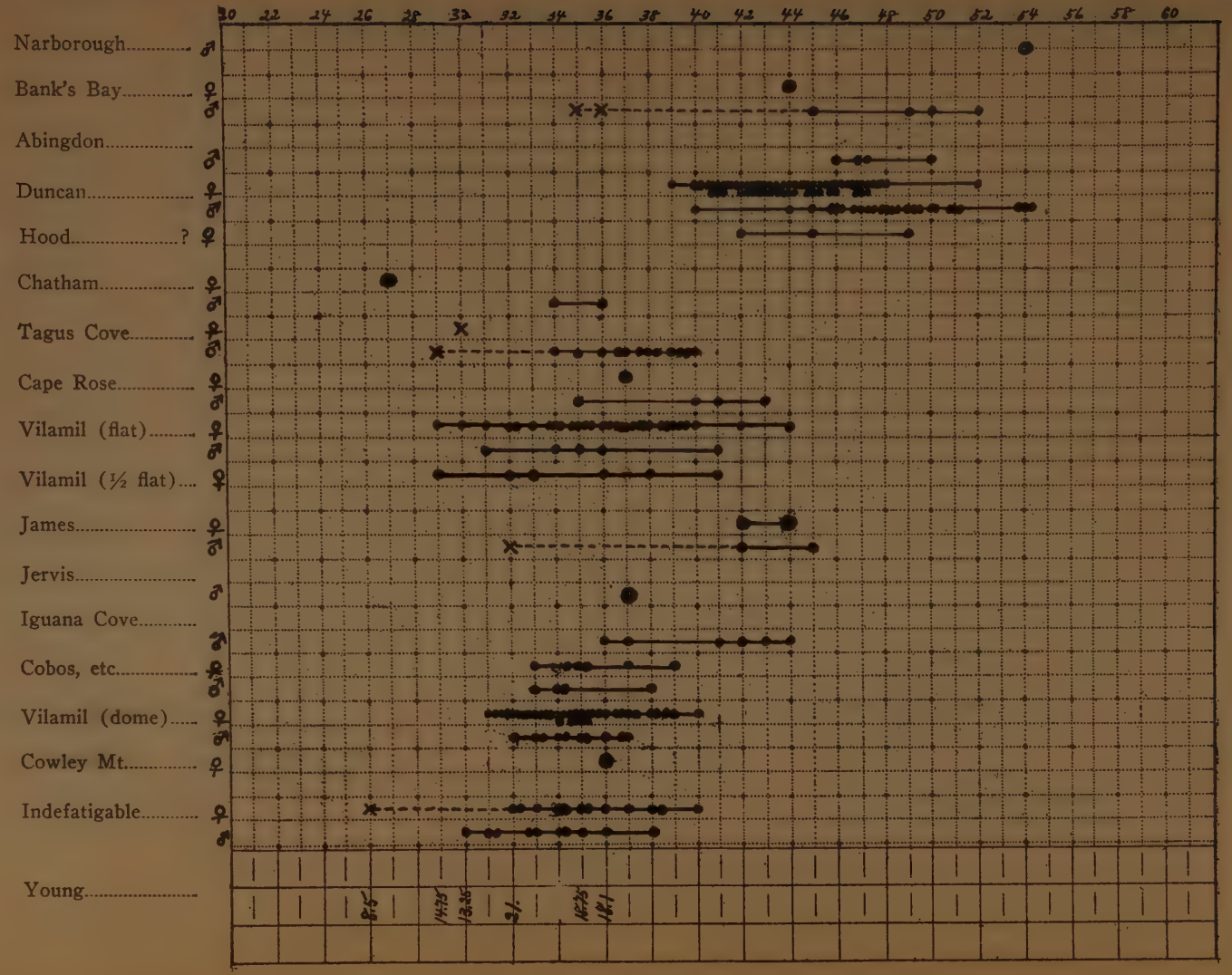


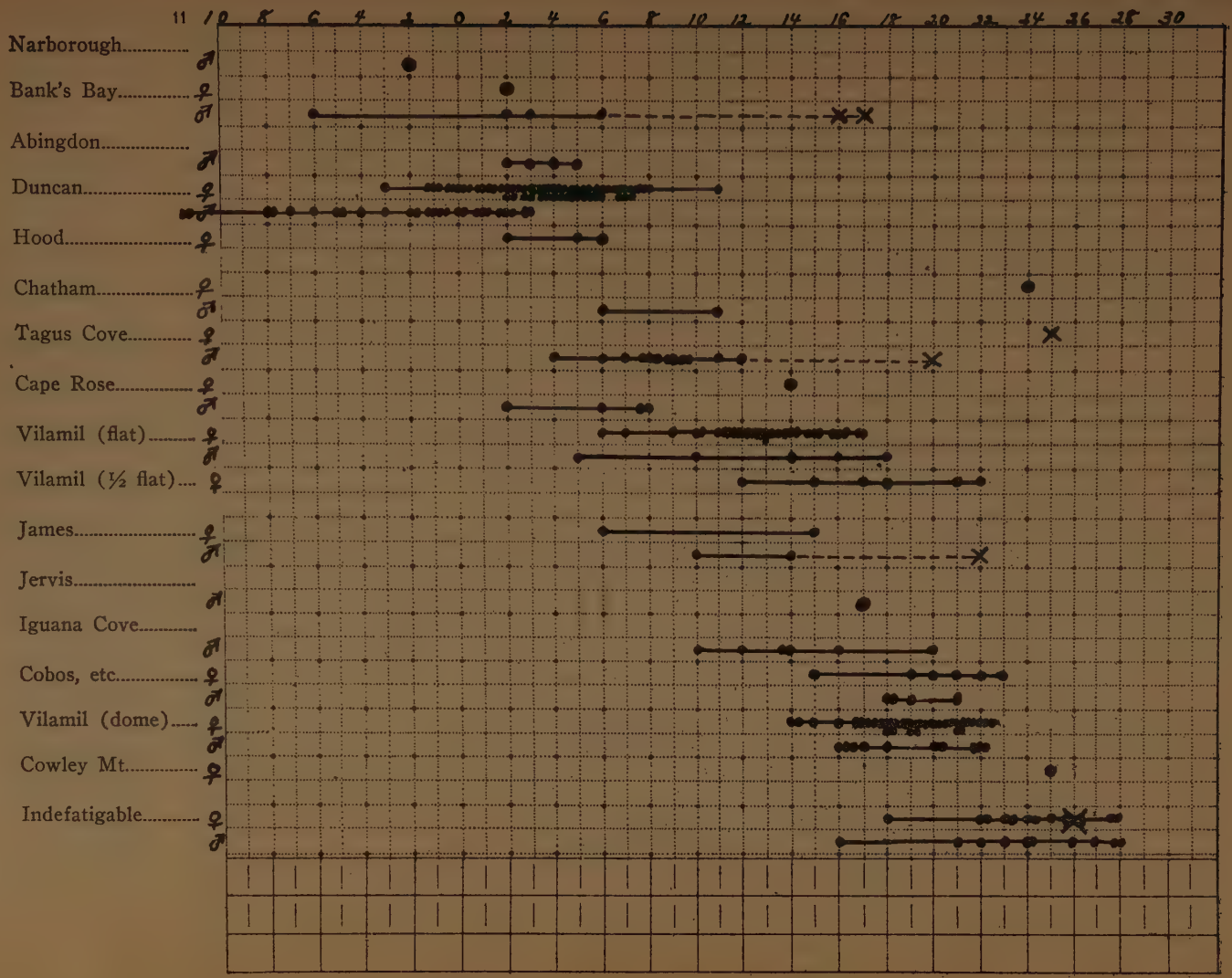

Curved Width Exceeds Width———Curved Width Exceeds Length.



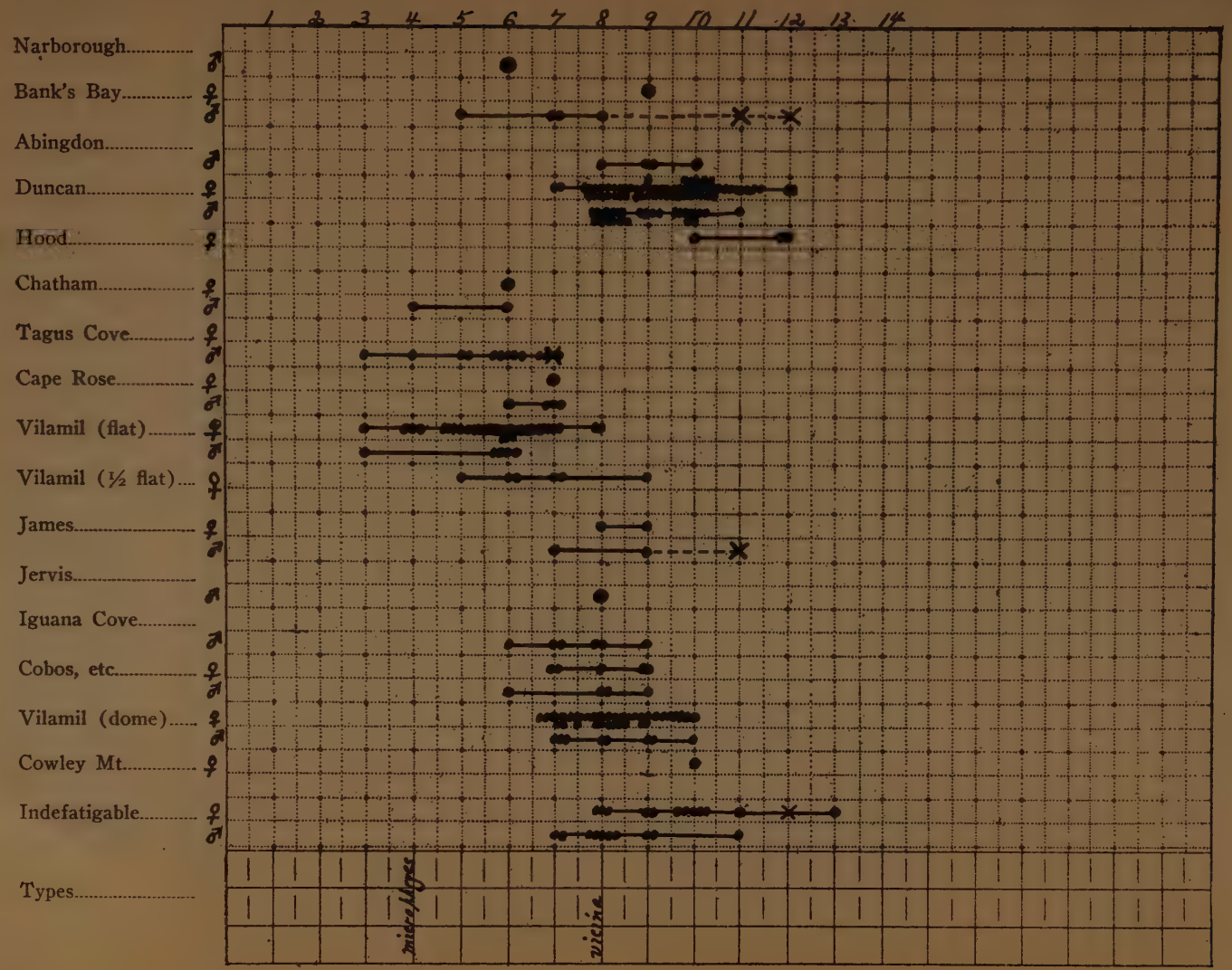

Width at 2d to 3d Marginals.


36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70
Narborough ♂
Bank's Bay ♀♂
Abingdon ♂
Duncan ♀♂
Hood ♀
Chatham ♀♂
Tagus Cove ♀♂
Cape Rose ♀♂
Vilamil (flat) ♀♂
Vilamil (½ flat) ♀
James ♀♂
Jervis ♂
Iguana Cove ♂
Cobos, etc. ♀♂
Vilamil (dome) ♀♂
Cowley Mt. ♀
Indefatigable ♀♂
Types
X=Young
microphyes
galapagoensis
abingdonii
Middle Height.

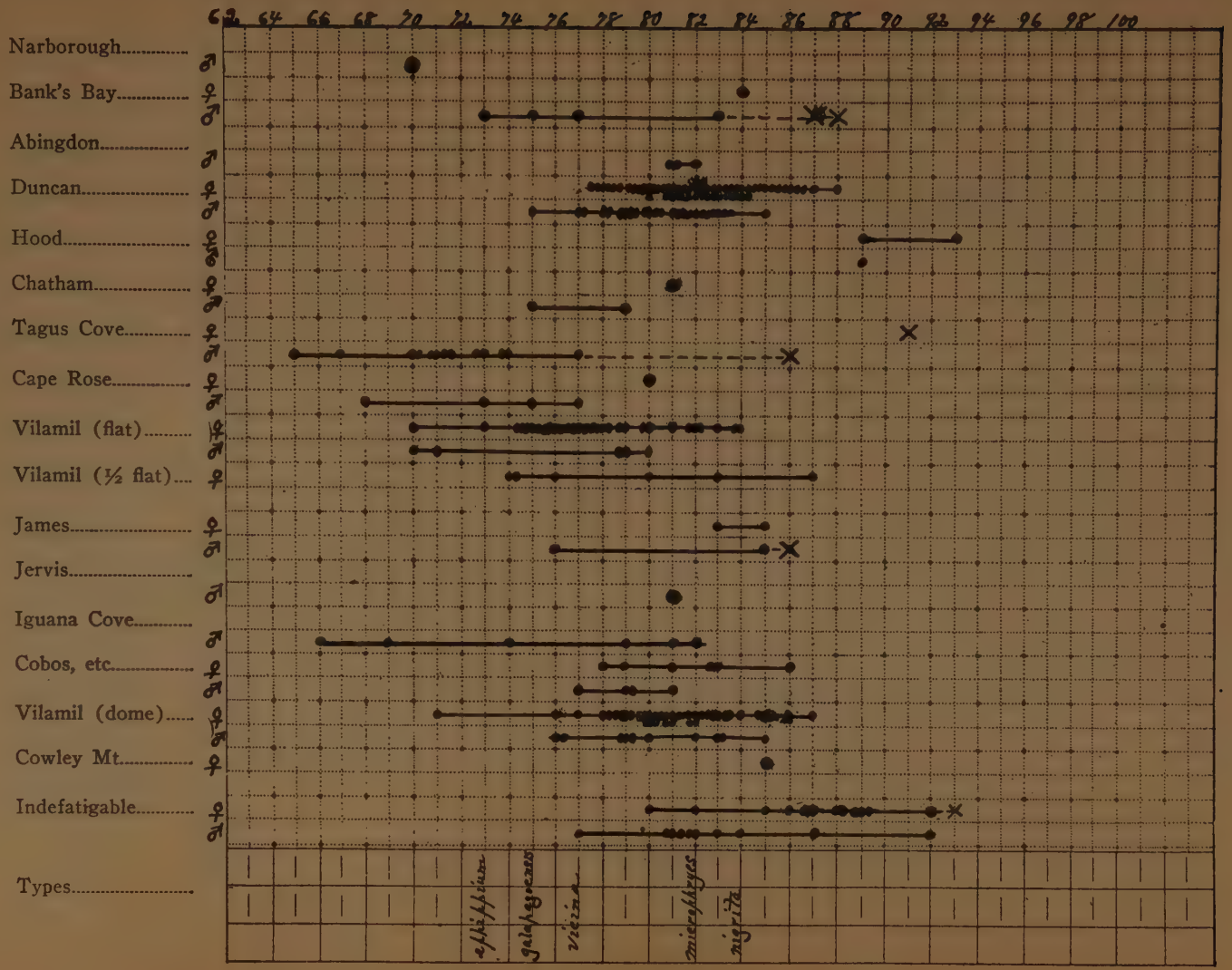

20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60
Narborough ♂
Bank's Bay ♀ ♂
Abingdon ♂
Duncan ♀ ♂
Hood ? ♀
Chatham ♀ ♂
Tagus Cove ♀ ♂
Cape Rose ♀ ♂
Vilamil (flat) ♀ ♂
Vilamil (½ flat) ♀
James ♀ ♂
Jervis ♂
Iguana Cove ♂
Cobos, etc. ♀ ♂
Vilamil (dome) ♀ ♂
Cowley Mt. ♀
Indefatigable ♀ ♂
Young
Front Height.


11 10 8 6 4 2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Narborough ♂
Bank's Bay ♀ ♂
Abingdon ♂
Duncan ♀
♂
Hood ♀
Chatham ♀ ♂
Tagus Cove ♀ ♂
Cape Rose ♀ ♂
Vilamil (flat) ♀ ♂
Vilamil (½ flat) ♀
James ♀ ♂
Jervis ♂
Iguana Cove ♂
Cobos, etc. ♀ ♂
Vilamil (dome) ♀ ♂
Cowley Mt. ♀
Indefatigable ♀ ♂

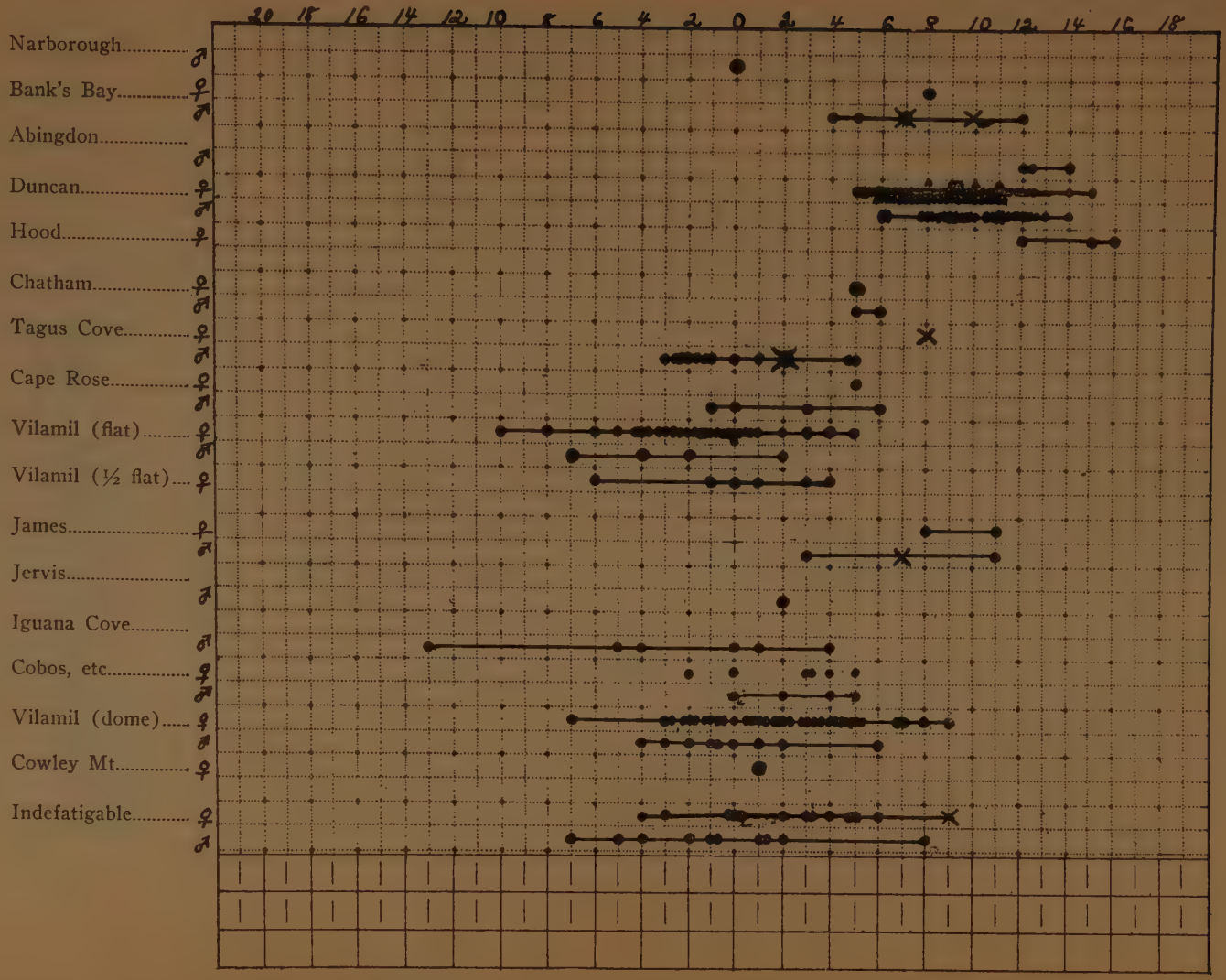
Front Height Compared with Middle Height.




Height to Marginals.




Length of Plastron.


20 18 16 14 12 10 8 6 4 2 0 2 4 6 8 10 12 14 16 18
Narborough ♂
Bank's Bay ♀♂
Abingdon ♂
Duncan ♀♂
Hood ♀
Chatham ♀♂
Tagus Cove ♀♂
Cape Rose ♀♂
Vilamil (flat) ♀♂
Vilamil (½ flat) ♀
James ♀♂
Jervis ♂
Iguana Cove ♂
Cobos, etc. ♀♂
Vilamil (dome) ♀♂
Cowley Mt. ♀
Indefatigable ♀♂
Straight Width Exceeds Length of Plastron
Length of Plastron Exceeds Straight Width.

## TABLE OF AVERAGE MEASUREMENTS OF TORTOISES.

| Locality | Number | Sex | Straight Width Per Cent | Curved | | | Width 2d to 3d marginals—Per Cent | Height | | | Height to marginals Per Cent | Plastron Per Cent | Fore Limb Per Cent | Hind Limb Per Cent | Axilla to Elbow Per Cent | Neck Per Cent | Tail Per Cent |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Length Per Cent | Width Per Cent | Width Minus Length Per Cent | | Middle Per Cent | Front Per Cent | Middle Minus Front Per Cent | | | | | | | |
| Narborough | 1 | ♂ | 70 | 124 | 116 | —8 | 46 | 52 | 54 | —2 | 6 | 70 | | | | | |
| Bank's Bay | 2 | young | 79 | 126 | 115.5 | —10.5 | | 52 | 35.5 | 16.5 | 11.5 | 87.5 | 53 | 49 | 28 | 54 | 15 |
| Bank's Bay | 1 | ♀ | 76 | 114 | 111 | —3 | 54 | 46 | 44 | 2 | 9 | 84 | | | | | |
| Bank's Bay | 4 | ♂ | 70 | 118.5 | 116 | —1 | 48 | 50 | 49 | 1 | 7 | 77 | 56 | 50 | 27 | 72 | 16 |
| Abingdon | 4 | ♂ | 69.5 | 118 | 107 | —8 | 37 | 50 | 47.5 | 3.5 | 9 | 81 | 60 | 53 | 29 | 63 | 17 |
| Duncan | 61 | ♀ | 73 | 115 | 114 | —15 | 49 | 48 | 44 | 3.5 | 9 | 82 | 55 | 51 | 29.5 | 63 | 8 |
| Duncan | 25 | ♂ | 71 | 115 | 109 | —6 | 48 | 46 | 48 | —2 | 9 | 80 | 56 | 52 | 29 | 69 | 13 |
| Hood | 2 | ♀ | 75.5 | 117 | 112 | —5 | 44.5 | 49.5 | 45.5 | 4 | 11 | 91 | 55 | 50 | 33 | 52 | 7 |
| Hood | 1 | ♂ | 77 | 122 | 112 | —10 | 45 | 50 | 45 | 5 | 12 | 89 | 56 | 52 | 27 | 59 | 7 |
| Chatham | 1 | ♀ | 76 | 126 | 116 | —10 | 46 | 51 | 27 | 24 | 6 | 81 | 46 | 45 | 21 | 52 | 13 |
| Chatham | 2 | ♂ | 71.5 | 114.5 | 113.5 | —1 | 53 | 43.5 | 35 | 8.5 | 5 | 77 | | | | | |
| Tagus Cove | 2 | young | 83.5 | 128.5 | 125 | —3.5 | | 52 | 29.5 | 22.5 | 7 | 88.5 | 43 | 41 | | 49 | 9 |
| Tagus Cove | 12 | ♂ | 71 | 118 | 116 | —2 | 51 | 46 | 37.5 | 8 | 5 | 71 | 45.5 | 40.5 | 26.5 | 53 | 12 |
| Cape Rose | 1 | ♀ | 75 | 123 | 127 | +4 | 54 | 51 | 37 | 14 | 7 | 80 | 53 | 47 | 22 | 53 | 7 |
| Cape Rose | 4 | ♂ | 69 | 118 | 115 | —3 | 56 | 46 | 40 | 6 | 7 | 73 | 48 | 42 | 24 | 46 | 11 |
| Vilamil (flat) | 30 | ♀ | 79 | 119 | 127 | +9 | 52 | 49 | 35 | 13 | 6 | 78 | 47 | 42 | 21 | 48 | 7 |
| Vilamil (flat) | 5 | ♂ | 78 | 118 | 126 | +8 | 56 | 48 | 35 | 13 | 5 | 74 | 45 | 41 | 25 | 51 | 10 |
| Vilamil (half flat) | 6 | ♀ | 79 | 121 | 130 | +9.5 | 51 | 52 | 35 | 17.5 | 7 | 79 | 49 | 40 | 24 | 50 | 5 |
| James | 1 | young | 79 | 126 | 119 | —7 | 51 | 54 | 32 | 22 | 11 | 86 | | | | | |
| James | 2 | ♀ | 74.5 | 122.5 | 121.5 | —1 | 57 | 53.5 | 43 | 10.5 | 8.5 | 84 | | | | | |
| James | 2 | ♂ | 73.5 | 127 | 123.5 | —3.5 | 51.5 | 55.5 | 43.5 | 12 | 8 | 80.5 | 49.5 | 44.5 | 30 | 59 | 13.5 |
| Jervis | 1 | ♂ | 79 | 134 | 129 | —5 | 54 | 54 | 37 | 17 | 8 | 81 | 53 | 44 | 25 | 57 | 17 |
| Iguana Cove | 6 | ♂ | 78 | 122 | 129 | +8 | 55 | 54 | 40.5 | 14 | 7.5 | 75 | 51.5 | 45 | 31 | 55 | 11 |
| Vilamil Dome | 35 | ♀ | 79 | 127 | 130 | +3 | 54 | 54 | 35 | 19 | 8.5 | 81 | 46 | 39 | 25.5 | 51 | 9 |
| Vilamil Dome | 10 | ♂ | 80 | 128 | 129 | +2 | 51 | 53 | 34.5 | 19 | 8 | 80 | 47.5 | 43 | 25 | 51 | 10.5 |
| Cowley Mt. | 1 | ♀ | 84 | 128 | 138 | +10 | 54 | 61 | 36 | 25 | 10 | 85 | 48 | 49 | 27 | | 9 |
| Indefatigable | 1 | young | 84 | 132 | 124 | —8 | 53 | 52 | 26 | 26 | 12 | 93 | | | | | |
| Indefatigable | 9 | ♀ | 85 | 132 | 139 | +7 | 56 | 60 | 36 | 25 | 9 | 86 | 47 | 45 | 28 | 51 | 7 |
| Indefatigable | 9 | ♂ | 83 | 133 | 135 | +3 | 60 | 58 | 33 | 23 | 8 | 82 | 52 | 47 | 25.5 | 57.5 | 11 |

## TABLE OF EXTREME MEASUREMENTS OF TORTOISES.

| Locality | Number | Sex | Straight | | Curved | | Width 2d to 3d marginals Per Cent | Height | | Height to marginals Per Cent | Plastron Per Cent | Fore Limb Per Cent | Hind Limb Per Cent | Axilla to Elbow Per Cent | Neck Per Cent | Tail Per Cent |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Length Inches | Width Per Cent | Length Per Cent | Width Per Cent | | Middle Per Cent | Front Per Cent | | | | | | | |
| Narborough | 1 | ♂ | 34.5 | 70 | 124 | 116 | 46 | 52 | 54 | 6 | 70 | | | | | |
| Bank's Bay | 1 | ♀ | 21.75 | 76 | 114 | 111 | 54 | 46 | 44 | 9 | 84 | | | | | |
| Bank's Bay | 4 | ♂ | 34-41.5 | 69-71 | 116-121 | 110-120 | 40-53 | 46-53 | 45-52 | 5-8 | 73-83 | 50-62 | 47-54 | 24-32 | 64-78 | 12-18 |
| Abingdon | 4 | ♂ | 29.3-36 | 68-72 | 115-119 | 105-116 | 36-38 | 47-51 | 46-50 | 8-10 | 81-82 | 57-62 | 47-58 | 24-33 | 51-74 | 15-18 |
| Duncan | 63 | ♀ | 18.4-27 | 67-79 | 110-122 | 100-126 | 44-56 | 39-54 | 39-52 | 7-12 | 78-88 | 52-60 | 48-59 | 25-31 | 60-66 | 2-11 |
| Duncan | 25 | ♂ | 23.25-29.5 | 66-75 | 109-122 | 99-120 | 39-59 | 42-51 | 40-54 | 8-11 | 75-85 | 55-60 | 49-56 | 24-33 | 61-75 | 11-14 |
| Hood | 2 | ♀ | 19.75-21 | 74-77 | 111-123 | 109-115 | 44-45 | 48-51 | 42-49 | 10-12 | 89-93 | 55 | 50 | 33 | 52 | 7 |
| Hood | 1 | ♂ | 22.2 | 77 | 122 | 112 | 45 | 50 | 45 | 12 | 89 | 56 | 52 | 27 | 59 | 7 |
| Chatham | 1 | ♀ | 22.5 | 76 | 126 | 115 | 46 | 51 | 27 | 6 | 81 | 46 | 45 | 21 | 52 | 13 |
| Chatham | 2 | ♂ | 25.25-35.25 | 69-76 | 112-117 | 108-119 | 53 | 40-47 | 34-36 | 4-6 | 75-79 | | | | | |
| Tagus Cove | 12 | ♂ | 34.5-40.5 | 62-75 | 114-122 | 107-123 | 46-56 | 42-49 | 33-40 | 3-7 | 65-77 | 36-50 | 26-46 | 24-29 | 48-57 | 10-16 |
| Cape Rose | 1 | ♀ | 25 | 75 | 123 | 127 | 54 | 51 | 37 | 7 | 80 | 53 | 47 | 22 | 53 | 7 |
| Cape Rose | 4 | ♂ | 29.2-38 | 69-75 | 114-122 | 110-119 | 54-57 | 43-48 | 35-43 | 6-7 | 68-77 | 44-51 | 41-43 | 23-26 | 45-47 | 9-12 |
| Vilamil (flat) | 30 | ♀ | 24-28.8 | 74-86 | 115-124 | 122-137 | 46-61 | 44-53 | 29-44 | 3-8 | 70-84 | 42-55 | 36-49 | 18-24 | 48-52 | 5-9 |
| Vilamil (flat) | 5 | ♂ | 24.5-40 | 73-83 | 116-121 | 123-128 | 52-61 | 46-50 | 31-41 | 3-6 | 70-80 | 45 | 41 | 25 | 51 | 10 |
| Vilamil (half flat) | 6 | ♀ | 23.7-27.8 | 70-88 | 114-128 | 116-142 | 48-54 | 50-55 | 29-41 | 5-9 | 74-87 | 49 | 40 | 24 | 50 | 5 |
| James | 2 | ♀ | 25.75-30 | 72-77 | 119-126 | 114-129 | 56-58 | 50-57 | 42-44 | 8-9 | 83-85 | 48-52 | 44-48 | 20-23 | 44-54 | 6-9 |
| James | 3 | ♂ | 21-40.25 | 73-79 | 125-129 | 119-125 | 48-55 | 54-56 | 32-42 | 7-11 | 76-86 | 47-52 | 43-46 | 30 | 56-62 | 9-18 |
| Jervis | 1 | ♂ | 36.2 | 79 | 134 | 129 | 54 | 54 | 37 | 8 | 82 | 53 | 44 | 25 | 21 | 17 |
| Iguana Cove | 6 | ♂ | 34.3-43 | 73-87 | 115-126 | 116-138 | 52-57 | 49-58 | 36-44 | 6-9 | 66-82 | 47-51 | 40-55 | 28-33 | 51-68 | 10-13 |
| Cobos, etc | 6 | ♀ | 26.3-30.2 | 78-82 | 127-131 | 129-134 | 52-55 | 54-59 | 33-39 | 7-9 | 78-86 | | | | | |
| Cobos, etc | 4 | ♂ | 32-40.5 | 72-82 | 125-129 | 122-132 | 48-58 | 51-56 | 33-38 | 6-9 | 77-81 | 43-53 | 41-46 | 24-26 | 49-50 | 11-13 |
| Vilamil (dome) | 35 | ♀ | 21.25-31.2 | 75-84 | 124-134 | 123-140 | 48-58 | 51-57 | 31-40 | 7-10 | 71-87 | 30-53 | 28-47 | 22-30 | 46-54 | 6-12 |
| Vilamil (dome) | 10 | ♂ | 24-33.2 | 77-84 | 123-131 | 123-138 | 44.59 | 51-56 | 32-37 | 7-10 | 76-85 | 44-50 | 35-46 | 22-27 | 47-54 | 9-12 |
| Cowley Mt | 1 | ♀ | 26-75 | 84 | 128 | 138 | 54 | 61 | 36 | 10 | 85 | 48 | 49 | 27 | | 9 |
| Indefatigable | 12 | ♀ | 21.75-35.8 | 82-89 | 125-138 | 122-146 | 53-60 | 54-63 | 32-40 | 8-13 | 80-92 | 43-49 | 40-48 | 26-30 | 46-58 | 5-8 |
| Indefatigable | 10 | ♂ | 23.6-41.4 | 75-90 | 126-141 | 125-146 | 54-71 | 55-61 | 30-38 | 7-11 | 77-92 | 48-60 | 45-51 | 23-29 | 56-59 | 7-16 |

Examination of these charts shows four kinds of variation in shape:

1. Variation with age.
2. Variation with sex.
3. Variation with distribution.
4. Individual variation.

1. *Variation with age.*—Young tortoises of all races are similar in shape. The racial characteristics become evident only after the tortoises have attained a considerable size. The differences between the young and adult are more marked in the male than in the female, and in the so-called saddle-backed than in the non-saddle-backed races. In other words, the young are all more or less dome-shaped, the elevation and constriction of the anterior portion of the carapace in the saddle-backed races being acquired later in life.

In the young, the front height averages less; while the middle height, the height to marginals, the curved length, the length of plastron, and the straight width average more than in the adult. The plastron is flat, notched posteriorly, and lacks the posterior knob-like thickenings which later develop in the males.

2. *Variation with sex.*—In the purely dome-shaped races, such as that of Indefatigable Island, there is but little difference in shape between the sexes. In the intermediate races, such as those of Tagus Cove, Iguana Cove, James and Chatham Islands, the female retains the high-backed, low-fronted carapace; while in the male the anterior portion becomes elevated, and the back, in consequence, appears flattened. In the saddle-backed races, the males have the anterior portion raised still higher, so that it sometimes is higher than the middle of the carapace, and the first costal plates with the corresponding marginals appear as though pressed inward toward the median line. The females of these races show this elevation and constriction, but in a lesser degree.

In adult males the plastron often is quite concave, is shorter than in females, and is thickened at its posterior extremity into broad knob-like masses. These tumefactions seem to be peculiar to the males except in one race. In *Testudo güntheri* of

southeastern Albemarle many of the female tortoises have these knobs as highly developed as in any male.[1]

The females are broader than the males. In them also the height to marginals usually is greater. The males attain a much larger size than the females.

3. *Variation with distribution.*—We have already stated that the tortoises from any island differ in shape from those from any other. When we consider how close these islands are one to another, it is not strange that these differences should be slight; nor are they the less interesting and worthy of study on this account. When we compare *Testudo abingdoni* with the tortoise of Indefatigable, or that of Narborough with that of Chatham, the differences are, indeed, great. Had we specimens from these islands only, we should, without hesitation, regard them as very distinct species. But when we have before us a large number of tortoises from many islands, we find that the matter of their separation becomes most difficult. When we chart our measurements, we see at once that, while certain forms are very dissimilar, others are much less so, and that when the entire group of races is considered the change is so gradual that no sharp lines of distinction can be drawn. It is evident that there are two main groups: the saddle-backed and non-saddle-backed races. But the differences between even these are to a great extent bridged by such forms as the James (*T. darwini*), the Tagus Cove (*T. microphyes*), and the Chatham Island (*T. chathamensis*) tortoises. Nevertheless, the differences are real, and appear in the table of averages. The extremes of individual variation in races so closely related must overlap and prevent clear diagnosis, unless this variation can in some way be hidden. Now, extremes of variation in any one tortoise rarely affect more than a few measurements. It therefore is possible, by selecting the measurements which best bring out the racial differences, and by combining them in various ways, to bury, as it were, the extremes of individual variation by a process of summation of characters. It is only in this way that we can hope to make a key for the separation of the various races. Even when thus constructed the key must be inadequate for the separation of some specimens. All

[1]Since this seems to be true also in the type of Günther's *T. microphyes* I was at first inclined to associate the latter name with this race, but it seems better to follow Günther's use of the term. See remarks p. 253 *ante*.

that can be said for it is that it seems the only solution of a most difficult problem, and must be regarded as a necessary evil.

Although sharp lines cannot be drawn between the various races, I shall use binomials in referring to them, since I believe nothing is to be gained by a more cumbersome nomenclature when dealing with such insular forms.

4. *Individual Variation.*—In the shape of the carapace this variation is very considerable, as is shown by the charts of measurements. There is also much variation in the size attained by different specimens. Some very old individuals are much smaller than younger ones of the same races. The horny plates are remarkably constant in number and shape, but certain individual variations occur. The type of *T. microphyes* has the anterior two marginals of each side merged into single plates. One specimen of *Testudo vicina* (No. 8254) from Vilamil has an intergular plate. Another (No. 8196) has a single light-yellow ray on one second costal, and an extra plate in the front part of the plastron. Van Lidth de Jeude has figured a specimen of *T. ephippium* in which the pectorals do not reach the midline. This variation seems not very rare in this race. I have noted it in Nos. 8321 and 8333; and Nos. 8332 and 8367 have the left pectorals not extending to the midline, although those of the right side reach it. In this Duncan Island race also No. 8375 has five left costals, No. 8326 has five right costals, and No. 8361 has five right costals, and also has the third vertebral divided into three irregular portions. In No. 8265 (*Testudo güntheri*) the pectorals are divided longitudinally.

The Soft Parts.—These also vary with age, with sex, individually, and with race. The young have proportionally shorter necks, limbs, and tails than the adults; and the adult females have these parts proportionally shorter than the adult males. In the saddle-backed races these parts are longer than in the dome-shaped races. Both sexes of the saddle-backed races usually have more or less yellow on the lower jaw and throat. This coloration appears also in some of the males of *T. güntheri,* and is found also in the James Island race. The non-saddle-backed forms, the Tagus Cove race, and at least the females of the Chatham race are entirely blackish brown.

Osteological Differences.—Those which have been considered of taxonomic value are mainly differences which appear in the skulls, cervical vertebrae, shoulder-girdle, pelvis, and large limb bones. As in the case of the shell, these are differences of proportion. It has been stated that *Testudo becki* and the Charles Island tortoise (*T. elephantopus s. galapagoensis*) differ from the other races in having the third instead of the fourth cervical vertebra biconvex. This condition in the type of *T. becki* is an individual variation, since it is the fourth vertebra which is biconvex in my series of seven specimens from Bank's Bay. The condition doubtless is anomalous also in the Charles Island specimen. The differences in proportion of the bones of the limbs and neck correspond with the relative length of these parts in the various races, the number of bones being the same in all. They are proportionally shorter in the dome-shaped races, and longer in those in which the carapace is elevated and compressed anteriorly. These differences are shown in the measurements of the limbs and neck given with the description of each race or species. Certain differences in the skulls of the tortoises of the various races have been pointed out by Dr. Günther. I believe that the differences he has indicated are all merely individual variations. In a series of 24 skulls from Vilamil, Albemarle, I find all of the variations which Dr. Günther mentions; and upon careful comparison of this series with one skull from Hood Island (No. 8125), one from Indefatigable (No. 8381), one from James (No. 8105), three from Duncan (Nos. 8378, 8379, and 8380), four from Chatham (Nos. 8127, 8128, 8130, and 8131), and one from Iguana Cove (No. 8179), I can find no constant differences in the skulls of the various races. In the skulls from Vilamil, the frontal region may be flat or somewhat convex. The occipital spine may be short or long, not reaching the posterior borders of the mastoid processes or projecting far behind them, and may or may not rise much above the level of the skull. There is much variation in the shape of the tympanic case and cavity. The fossa in front of the occipital condyle may be deep or very shallow. The tuberosity for the temporal muscle may be quite small or very largely developed. The nasal opening may be as high as broad, or broader than high. The palatal

region varies much in shape. It may be narrow or broad, and the pterygoid edges may be sharp or blunt. The alveolar ridges also vary in position and degree of development. We may safely say that no constant differences exist among the skulls of the various races of Galapagoan tortoises.

## Key to Galapagoan Races

a.—Saddle-backed races.—The sum of the percentage straight width, curved width, width between second and third marginals, and the difference between front and middle heights is less than, or exceeds by not more than 10, the sum of the percentage straight length, front height, twice the height to marginals, and length of plastron; or else straight width less than 66%.

b.—Plastron more than 72%; percentage of plastron exceeds that of straight width by not less than 3; distance between prominent points of first marginals less than 30%; front height usually less than 53%.

c.—Plastron more than 88%. Height to marginals 10 to 12%. Hood Island.
**T. hoodensis.—p. 313.**

c².—Plastron not more than 88%;

d.—Width at 2nd to 3rd marginals less than 39%; eighth marginal much reduced and wedgeshaped at top; height to marginals 8 to 10%. Abingdon Island.
**T. abingdoni.—p. 296.**

d².—Width at 2nd to 3rd marginals not less than 39%; eighth marginal with a considerable superior margin.

e.—Width at 2nd to 3rd marginals plus middle height minus front height equals less than 59%;

f.—Height to marginals greater, 7 to 12%; size small; plastron often shorter. Duncan Island.
**T. ephippium.—p. 306.**

f².—Height to marginals less, 5 to 9%; size large; plastron often longer. Northern Albemarle.
**T. becki.—p. 303.**

e².—Width at 2nd to 3rd marginals plus middle height minus front height equals not less than 60% (one small ♀). James Island.
**T. darwini.—p. 319.**

b².—Plastron less than 72%; percentage of plastron not exceeding that of straight width; distance between prominent points of first marginals more than 30%; front height more than 53%; curved length more than 123%.
Height to marginals less than 7%. Narborough Island.
**T. phantastica.—p. 299.**

a².—Non-saddle-backed races. The sum of the percentage straight width, curved width, width between second and third marginals and the difference between front and middle heights exceeds by more than ten the sum of the percentage straight length, front height, twice the height to marginals, and plastron.

bb.—The sum of the curved length, front height, middle height, and plastron, equals or exceeds the sum of the straight length, straight width and curved width; the front height is more than 41% of the straight length.

Straight width nor less than 72%; percentage of middle height exceeds percentage of front height by not less than six; curved length of male more than 122%; middle height in male not less than 54%; front height in male not exceeding 45%. James Island.

**T. darwini.—p. 319.**

bb$^2$.—The sum of the curved length, front height, middle height, and plastron, is less than the sum of the straight length, straight width, and curved width; or[1] the front height does not exceed 41% of the straight length.

cc.—The sum of the straight width, curved width and half the height to marginals is less than twice the straight length; the height to marginals is not more than 7%; the curved length does not exceed 126%; the middle height does not exceed 51%; the percentage of the curved width does not exceed the percentage of the curved length by more than 4.

dd.—Pectoral plates much reduced medially, (usually) not reaching the midline; plastron longer, its percentage exceeding that of straight width by more than 4. Chatham Island.

**T. microphyes.—p. 329.**

dd$^2$.—Pectoral plates not more reduced than in most races, meeting on the midline; plastron shorter, its percentage rarely exceeding that of straight width by more than 4. Tagus Cove, Albemarle.

**T. chathamensis.—p. 323.**

cc$^2$.—The sum of the straight width, curved width and half the height to marginals is not less than twice the straight length;[2] or (if not) the height to marginals is more than 7%; or the curved length exceeds 126%; or the middle height exceeds 51%; or the percentage of the curved width exceeds the percentage of the curved length by more than four;

ddd.—The sum of the straight width, middle height, difference between front and middle heights, and width at 2nd to 3rd marginals exceeds 218%; or the difference between percentages of front and middle heights not less than 26; or height to marginals more than 10%; or plastron more than 87%.

ee.—Curved length plus width at 2nd to 3rd marginals minus difference between curved length and curved width minus middle height equals not less than 112%. Indefatigable Island.

**T. porteri.—p. 354.**

ee$^2$.—Curved length plus width at 2nd to 3rd marginals minus difference between curved length and curved width minus middle height equals not more than 111%. Cowley Mountain, Albemarle.

**T. sp.—p. 362.**

ddd$^2$.—The sum of the straight width, middle height, difference between front and middle heights and width at 2nd to 3rd marginals not exceeding 218%; difference between percentages of front and middle heights less than 26; height to marginals not more than 10%; plastron not more than 87%.

[1]In 2 Indefatigable and 4 dome-shaped ♀♀ from South Albemarle.

[2]Three exceptions to this are 1 Iguana Cove, 1 Cobos, and 1 Vilamil specimen.

eee.—Marginal border not scalloped; first marginals without prominent points; height to marginals low, 3 to 8%; the sum of the curved length, middle height, difference between front and middle heights, and height to marginals is less than twice the straight length. Southeastern Albermarle.
**T. güntheri.—p. 335.**

eee$^2$.—Marginal border scalloped; first marginals with more or less prominent points; height to marginals greater, 6 to 10%; the sum of the curved length, middle height, difference between front and middle heights, and height to marginals usually is more than twice the straight length.

ff.—Width over curve greater, usually greater than length over curve. South Albemarle.
**T. vicina.—p. 344.**

ff$^2$.—Width over curve less, not equal to length over curve. Jervis Island.
**T. wallacei.—p. 351.**

## Descriptions of the Races

In the following pages each race or species of Galapagoan tortoise is treated separately. Since these tortoises are structurally so nearly identical, and differ chiefly in shape and proportions, it has been thought best to omit long descriptions of each race. Instead, brief diagnoses are given, and it is hoped that the numerous photographs of specimens, together with the tables of measurements, will convey a more accurate and comprehensive knowledge of these tortoises than any descriptions could.

The field notes were made by Mr. Slevin.

## Testudo abingdoni Günther

Abingdon Island Tortoise

Plates 24 to 29.

*Testudo abingdonii* Günther, P. Z. S., 1877, p. 66; Günther, Gigantic Land Tortoises Brit. Mus., 1877, p. 85, pls. XI, XII, XIV figs. D-F, XLVIII-L; Boulenger, Cat. Chelonians Brit. Mus., 1889, p. 171; Baur, Am. Nat., XXIII, 1889 [1890] p. 1041, 1044 (part); Gadow, Cambridge Nat. Hist., VIII, 1901, p. 378; Heller, Proc. Washington Acad. Sci., V. 1903, p. 59; Beck, Seventh Report N. Y. Zool. Soc., 1903, p. 17; Siebenrock, Zool. Jahrb., Suppl. X, 3, 1909, p. 535.

*Type specimens.*—British Museum. Three adult males. Straight length 38, 34, and 38½ inches. Taken on Abingdon Island, by Commander Cookson, in 1875.

*Distribution.*—This species seems to be confined to the moist district near the southern end of Abingdon Island.

*Material.*—The Academy has complete skins of three adult males and a nearly complete bony shell of a fourth. There is a skeleton in the U. S. National Museum. The British Museum contains the types, and the Tring Museum has one adult male and one young example. So far as I can learn, no female has ever been collected.

*Diagnosis.*—No nuchal; gulars paired; fourth cervical vertebra biconvex; front of carapace high, higher than, or but little lower than, middle; height at nuchal notch more than 45% (46 to 50%) of straight length; difference between percentage of heights at third vertebral and at nuchal notch less than 9 (2 to 5); carapace saddle-shaped, very narrow anteriorly, width at margin of junction of second and third marginals not more than 38% (36 to 38%); first marginals not greatly enlarged, not much everted, their ventral surfaces not vertical, their most prominent points separated by less than 30% (20 to 26%); length over curve not more than 123% (115 to 119%); greater than width over curve; vertical distance from lower surface of plastron to lower edge of lateral marginals great, 8 to 10%; general size large, straight length 29.3 to 36 inches; plastron long, median length 81 to 82%; plates generally smooth; pectorals forming a suture on median line; eighth marginal plate wedge-shaped with very short superior border; lower jaw and throat of male marked with yellow.

## TABLE OF MEASUREMENTS OF ABINGDON ISLAND TORTOISES.

| Number | Sex | Straight | | | Curved | | | Width 2d to 3d marginals | | Height | | | | Height to marginals | | Plastron | | Fore Limb | | Hind Limb | | Axilla to Elbow | | Neck | | Tail | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Length | Width | Per Cent | Length | Width | Per Cent | | Per Cent | Middle | Per Cent | Front | Per Cent | | Per Cent | | Per Cent | | Per Cent | | Per Cent | | Per Cent | | Per Cent | | Per Cent |
| 8112 | ♂ | 36. | 24.8 | 69 | 41.4 | 37.8 | 105 | 13.7 | 38 | 16.75 | 47 | 17.9 | 50 | 3. | 8 | 29. | 81 | 20.4 | 57 | 16.8 | 47 | 9.6 | 24 | 22.6 | 63 | 6.6 | 18 |
| 8111 | ♂ | 35. | 24.2 | 69 | 41.8 | 38.4 | 110 | 12.5 | 36 | 17.7 | 51 | 16.2 | 46 | 3.5 | 10 | 28.4 | 81 | 21.2 | 61 | 19.4 | 55 | 10. | 29 | 18. | 51 | 5.4 | 15 |
| 8110 | ♂ | 32. | 21.75 | 68 | 38. | 34.5 | 108 | 12.3 | 38 | 15.7 | 49 | 15. | 47 | 2.9 | 9 | 26.1 | 82 | 19.8 | 62 | 18.4 | 58 | 10.4 | 33 | 23.6 | 74 | 5.4 | 17 |
| 8113 | ♂ | 29.3 | 21. | 72 | 34.75 | 34. | 116 | | | 15. | 51 | 13.7 | 47 | 2.5 | 9 | | | | | | | | | | | | |

*General remarks.*—This is one of the most "saddle-backed" of the Galapagoan tortoises. It is most like *T. becki* of northern Albemarle and *T. ephippium* of Duncan. The former, however, is a larger species, while the Duncan race rarely if ever grows as large as the Abingdon one. The shells of the Abingdon tortoises are quite thin, and there is much yellow about the head in males.

*Field Notes**—

September 18, 1906.—Sailed this morning for Abingdon, where we anchored at 12:30 on the south side of the island, which appears to be the highest.

September 19, 1906.—Went up the mountain after tortoises. We commenced to get into good tortoise country at about seven or eight hundred feet elevation, the beginning of the green zone. There is not much earth, the ground being nearly all lava, but there is plenty of water and cactus. The top of the mountain is covered with fog most of the time, and everything is very wet. We saw fresh signs of tortoises soon after getting into the green zone, and soon found a trail. This we followed, and came upon a tortoise on the top of a large rock which contained a few small water holes. It is capital country for tortoises; we did not, however, look farther, but skinned and carried out our first find. Ochsner went up the mountain a little higher, and came upon another large male. There are trails all around the mountain side. Beck found a male on the southern slope of the mountain, lower down. He also found the fresh trail of another tortoise, but failed to find the tortoise. We expect to go in tomorrow and get the tortoise Oschner found. The one we got out today was a very fat male. Its stomach contained cactus.

September 20, 1906.—Spent the day getting out the tortoise found by Ochsner. Saw several trails but no new tortoises. Today Beck found the one the trail of which he saw yesterday, but it is too far in to get out. Expect tomorrow to get out the one he found yesterday. The stomach of the one skinned today contained cactus and grass.

September 21, 1906.—Went in after the tortoise which Beck found September 19. It was about a mile or two above the green zone on the southern slope of the mountain. Up there it is continually raining or foggy throughout the morn-

*All the field notes, unless otherwise stated, are by Mr. Joseph R. Slevin.

ing, but clears off in the afternoon. It is capital tortoise country, everything being green, with plenty of water and cactus. The three tortoises taken were very fat, and showed the effects of good living. We saw no other signs, and they probably are very rare on Abingdon Island. The stomach of the one collected today contained grass and cactus. Beck also found an old shell and a few bones in a cave, where the tortoise probably had fallen in and died. We carried these down, and they are in fairly good condition.

### **Testudo phantastica** Van Denburgh

Narborough Island Tortoise

Plates 30 and 31.

*Testudo phantasticus* Van Denburgh, Proc. Cal. Acad. Sci. (4), I, 1907, p. 4; Siebenrock, Zool. Jahrb., Suppl., X. 3, 1909, p. 535.

*Type specimen.*—California Academy of Sciences No. 8101. Adult male. Straight length 34.5 inches. Taken on Narborough Island, by R. H. Beck, April 5, 1906.

*Distribution.*—This tortoise is from Narborough Island.

*Material.*—The type specimen is the only one that ever has been seen.

*Diagnosis.*—No nuchal; gulars paired; fourth cervical vertebra biconvex; front of carapace high, not lower than middle; height at nuchal notch more than 41% (54%) of straight length; difference between percentages of height at third vertebral and at nuchal notch less than 9 (2); carapace saddle-shaped, narrow anteriorly, width at margin of junction of second and third marginals not more than 54% (46%); first marginals much enlarged, everted more than in any other race, their ventral surfaces nearly vertical, their edges from nuchal notch to prominent point nearly horizontal, prominent point almost a right angle; distance between prominent points of first marginals more than 30% (32%); length over curve more than 123% (124%), greater than width over curve; vertical distance from lower surface of plastron to lower edge of lateral marginals small, 6%; general size moderate, straight length 34.5 inches; plastron short, 70%; pectoral plates forming a suture on median line; eighth marginal not reduced; lower jaw and throat marked with yellow.

TABLE OF MEASUREMENTS OF NARBOROUGH ISLAND TORTOISES.

| Number | Sex | Straight | | Curved | | Width 2d to 3d marginals | | Height | | | | Height to marginals | | Plastron | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Length | Width | Length | Width | | | Middle | | Front | | | | | |
| | | | Per Cent | | Per Cent | | Per Cent | | Per Cent | | Per Cent | | Per Cent | | Per Cent |
| 8101 | ♂ | 34.5 | 24. | 42. | 41. | 16. | 46 | 18. | 52 | 18.75 | 54 | 2. | 5 | 24. | 70 |

*General remarks.*—This is a "saddle-backed" tortoise with the anterior marginal plates very strongly reverted. It seems most nearly related to *Testudo becki* of northern Albemarle, but no such enlargement and outward and backward development of the anterior marginals is seen in any other tortoise. The early voyagers did not report the presence of tortoises on Narborough Island, so the discovery of this species was rather unexpected.

*Field Notes.*—Leaving Tagus Cove, April 2, 1906, Mr. Beck and Mr. Hunter set out for Narborough to hunt for tortoises. The climbing of the volcano proved most arduous, but Mr. Beck, leaving Mr. Hunter at the lower level, pushed on to the rim of the crater. The story of the finding of the only tortoise known to have been taken upon this island is told by Mr. Beck as follows:

Starting at daylight on April 3, 1906, a point about one-half the distance to the top of Narborough Island was reached at noon. Here commenced a narrow "island" of lava of more ancient eruption than that over which the first stage of the journey was made. This "island" had scattering cactus and a few bushes and vines. As I worked up through this strip of lava I saw a few old droppings of a tortoise, and on examination I found he had been eating a considerable quantity of *Cereus,* a cactus that is not often attacked by other tortoises, as the spines are much more difficult to make way with. Many spines were found in some of the excrement. Thinking that if a tortoise were down in this desolate patch, there would be many on top, I climbed toward the top, stopping on the way at one small mount of much older larva, seemingly of about the same age as Tagus Cove Mountain, for there was considerable soil. There were no signs of tortoises here, though iguanas were plentiful. Reaching the base of the main crater at about 5 o'clock, I camped, and next morning climbed up to the top, which was, where I climbed, a plateau a half mile across to the edge of the crater. The crater was probably over 1000 feet deep and a half mile in diameter. The plateau was covered with rank grass with clumps of *Opuntia* near the outer edge and scattering *Cereus*—an excellent place for tortoises; but none was seen, nor any signs.

Returned to camp, and struck down to the place where the tortoise signs were. Reached it at 4:30 P. M., and laying down the pack commenced searching, and in a portion of the "island" of old lava found a still older flow where there was considerable soil. Here I found a tortoise trail which had been travelled the day before. I followed this, and soon found in the trail a rock which had been used for the same purpose that rocks in similar places on Tagus Cove Mountain have served ever since the whalers carried off all the female tortoises. Going on some distance farther the old male was found slowly feeding on grass near the trail. Getting my pack, I ate supper and skinned the tortoise by moonlight. Starting with him next morning, I reached the shore at 4:30 P. M.

## **Testudo becki** Rothschild

North Albemarle Island Tortoise

Plates 31 to 38.

*Testudo becki* Rothschild, Nov. Zool., VIII, 1901, p. 372; Van Denburgh, Proc. Cal. Acad. Sci. (4), I, 1907, p. 4; Siebenrock, Zool. Jahrb., Suppl. X, 3, 1909, p. 536.

*Testudo bedsi*, Heller, Proc. Washington Acad. Sci., V, 1903, p. 59 (err. typ.).

*Type specimen.*—Tring Museum, England. Adult male. Length 40.75 inches. Taken at Cape Berkeley, northern Albemarle, by R. H. Beck.

*Distribution.*—This tortoise seems to be confined to the northern end of Albemarle Island, where it has been taken near Bank's Bay and Cape Berkeley.

*Material.*—The Academy collection contains seven specimens, of which one is an adult female. The Tring Museum contains five adult males collected by Mr. Beck.

*Diagnosis.*—No nuchal; gulars paired; fourth cervical vertebra biconvex; front of carapace high, in males sometimes higher than middle; height at nuchal notch not less than 44% (44 to 52%) of straight length; difference between percentages of front and middle heights less than 9 (—6 to +6); carapace saddle-shaped, narrow anteriorly, width at margin of junction of second and third marginals not more than 54% (40 to 54%); first marginals not very greatly enlarged, not greatly everted, their ventral surfaces not vertical, their most prominent points separated by less than 30% (23 to 29%); length over curve not more than 123% (114 to 121%), greater than width over curve (except in one specimen); vertical distance from lower surface of plastron to lower edge of lateral marginals small—5 to 8% in males, 9% in female; general size large, straight length 34 to 41.5 inches; plastron of moderate length, 73 to 84%; plates nearly smooth in adults; pectorals forming a suture on median line; eighth marginal plate not reduced; lower jaw and throat of males marked with yellow.

## TABLE OF MEASUREMENTS OF BANK'S BAY, ALBEMARLE ISLAND TORTOISES.

| Number | Sex | Straight | | | Curved | | | | Width 2d to 3d marginals | Per Cent | Height | | | | Height to marginals | Per Cent | Plastron | Per Cent | Fore Limb | Per Cent | Hind Limb | Per Cent | Axilla to Elbow | Per Cent | Neck | Per Cent | Tail | Per Cent |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Length | Width | Per Cent | Length | Per Cent | Width | Per Cent | | | Middle | Per Cent | Front | Per Cent | | | | | | | | | | | | | | |
| 8115 | ♂ | 41.5 | 28.5 | 69 | 50.25 | 121 | 48.25 | 116 | 22. | 53 | 21.25 | 51 | 18.6 | 45 | 3.25 | 8 | 30.2 | 73 | 20.8 | 50 | 19.6 | 47 | 10. | 24 | 26.4 | 64 | 7.2 | 17 |
| 8117 | ♂ | 37.3 | 26.2 | 70 | 44.3 | 119 | 43.8 | 117 | 14.8 | 40 | 19.2 | 51 | 18.2 | 49 | 2. | 5 | 28.6 | 77 | 22.4 | 60 | 20. | 54 | 10.8 | 26 | 26.8 | 72 | 4.4 | 12 |
| 8118 | ♂ | 34.25 | 24.1 | 70 | 39.8 | 116 | 37.75 | 110 | 16.25 | 47 | 15.6 | 46 | 17.7 | 52 | 2.25 | 7 | 25.75 | 75 | 18. | 53 | 16. | 47 | 8.4 | 25 | 24.4 | 74 | 6. | 18 |
| 8116 | ♂ | 34. | 24.3 | 71 | 40.1 | 118 | 40.8 | 120 | 18. | 53 | 18. | 53 | 17. | 50 | 2.5 | 7 | 28.1 | 83 | 21. | 62 | 18. | 53 | 10.8 | 32 | 26.6 | 78 | 6. | 18 |
| 8119 | ♂ | 18.75 | 14.5 | 77 | 23.5 | 125 | 21.5 | 115 | | | 9.8 | 52 | 6.75 | 35 | 2.12 | 11 | 16.25 | 87 | 10. | 53 | 9.2 | 49 | 5.2 | 28 | 10.12 | 54 | 2.8 | 15 |
| 8114 | ♂ | 18.1 | 14.7 | 81 | 23. | 127 | 21.1 | 116 | 9.4 | 52 | 9.4 | 52 | 6.6 | 36 | 2.25 | 12 | 15.9 | 88 | | | | | | | | | | |
| 8120 | ♀ | 21.75 | 16.6 | 76 | 24.9 | 114 | 24.25 | 111 | 11.8 | 54 | 9.9 | 46 | 9.6 | 44 | 2. | 9 | 18.25 | 84 | | | | | | | | | | |

*General remarks.—Testudo becki* is a very large "saddle-backed" tortoise with a thick, heavy shell. The female specimen, however, although evidently an old individual, is small and might easily be mistaken for some of the Duncan Island females. One of the large males is less compressed in front, and somewhat resembles the James Island males.

*Field Notes*—April 9 to 16, 1906.—Prepared to go to Bank's Bay, and sailed in the boat with the mate. We had light breezes and were out all night. The skiff picked us up in the morning, and we towed up to the camping beach. The mountain appears very much like the one at Tagus Cove, but has two recent lava-flows running down the side. The vegetation is very dense and green. The flat, however, at this time was getting dry, and the tortoises had evidently gone up higher, as we got only seven. Their trails were numerous and distinct. They fed chiefly on a coarse grass that is abundant at the foot of the mountain. No cactus was found in any of the stomachs examined, and not much water was found in the sac around the heart. This fluid is somewhat oily, and not thin like water. The country at the foot of the mountain is brushy, with some large trees, quite a bit of reddish soil, and some lava-flows fairly well covered. Beck and I went up the coast about three miles to an isolated patch of brush and trees to see if there were any signs of tortoises, but saw none. I should suppose the only chance of their being there would be if they had happened to be along the coast during the wet season, and were then shut off by the recent lava-flows, for the distance to travel from the mountain would be too great. We made a stay of seven days at Banks Bay and collected seven tortoises. All these tortoises had comparatively longer necks than any others measured thus far. We left on the afternoon of the sixteenth and got back to the ship about midnight.

## Testudo ephippium Günther

Duncan Island Tortoise

Plates 39 to 52.

*Testudo ephippium* Günther, Trans. Royal Soc. Lond., CLXV, 1875, p. 271, pls. 34, 35 fig. B, 37 fig. C, 38 fig. C, 39 fig. C, 42 fig. B, 44 fig. B, 45 fig. B; Günther, Gigantic Land Tortoises Brit. Mus., 1877, p. 81, pls. XXXI B, fig. B, XXXIX, XLIV, XLII fig. C, XLIII fig. C, XLIV fig. C; Boulenger, Cat. Chelonians Brit. Mus., 1889, p. 171; Baur, Am. Nat. XXIII, 1889 (1890) p. 1040; Günther, Novit. Zool., III, 1896, p. 329, pls. XX-XXII; Lidth de Jeude, Notes Leyden Mus., XX, 1898, p. 126; pls. III-V; Gadow, Cambridge Nat. Hist., VIII, 1901, p. 378; Heller, Proc. Washington Acad. Sci., V, 1903, p. 57; Beck, Seventh Report N. Y. Zool. Soc., 1903, p. 15; Siebenrock, Zool. Jahrb., Suppl. X, 3, 1909, p. 534.

*Testudo abingdonii* (part), Baur, Am. Nat., XXIII, 1889 (1890), p. 1039.

*Type specimen.*—Museum of Science and Arts, Edinburgh. Adult male. Straight length 33 inches. Origin unknown.

*Distribution.*—This tortoise has been found only on Duncan Island.

*Material.*—There are in the Academy's collection eighty-six specimens of this tortoise. Twenty-five of these are males. This race and those found in southeastern Albemarle are the ones most abundantly represented in museums.

*Diagnosis.*—No nuchal; gulars paired; fourth cervical vertebra biconvex; front of carapace high, higher than or but little lower than middle; height at nuchal notch more than 38% (39 to 54%) of straight length; difference between percentages of heights at third vertebral and at nuchal notch less than 12 (—11 to +11); carapace saddle-shaped, usually narrow anteriorly, width at margin of junction of second and third marginals not more than 39 to 59%; first marginals sometimes much everted, their most prominent points separated by less than 30% (17 to 29%); length over curve not more than 123% (109 to 122%); usually greater than width over curve; vertical distance from lower surface of plastron to lower edge of lateral marginals great—7 to 12%; general size rather small, straight length 18.4 to 29.5 inches; plastron of moderate length, 75 to 88%; plates generally smooth in adults; pectorals usually forming a suture on median line; eighth marginal plate not reduced, with a considerable superior border; lower jaw and throat in males marked with yellow.

## TABLE OF MEASUREMENTS OF DUNCAN ISLAND TORTOISES.

| Number | Sex | Straight | | | Curved | | | | Width 2d to 3d marginals | Per Cent | Height | | | | Height to marginals | Per Cent | Plastron | Per Cent | Fore Limb | Per Cent | Hind Limb | Per Cent | Axilla to Elbow | Per Cent | Neck | Per Cent | Tail | Per Cent |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Length | Width | Per Cent | Length | Per Cent | Width | Per Cent | | | Middle | Per Cent | Front | Per Cent | | | | | | | | | | | | | | |
| 8358 | ♂ | 29.5 | 21.75 | 74 | 35.25 | 119 | 35.5 | 120 | 14.25 | 48 | 15. | 51 | 14.5 | 49 | 2.8 | 9 | 23.6 | 80 | 16.6 | 56 | 14.4 | 49 | 8.8 | 30 | 19.7 | 67 | 3.3 | 11 |
| 8351 | ♂ | 29.5 | 20.5 | 69 | 34.3 | 116 | 33.6 | 114 | 11.5 | 39 | 14.2 | 48 | 13.3 | 45 | 2.25 | 8 | 23. | 78 | | | | | | | | | | |
| 8296 | ♂ | 28. | 19.75 | 71 | 33.3 | 119 | 33.4 | 119 | 12. | 43 | 13.75 | 49 | 13.1 | 47 | 2.15 | 8 | 23. | 82 | 16.8 | 60 | 15.2 | 54 | 6.8 | 24 | 17. | 61 | 3.6 | 13 |
| 8313 | ♂ | 27.1 | 19.7 | 73 | 31.4 | 116 | 29.6 | 109 | 13.3 | 49 | 12.1 | 45 | 12. | 44 | 2.25 | 8 | 21.4 | 79 | | | | | | | | | | |
| 8364 | ♂ | 27.1 | 19.1 | 71 | 31.6 | 117 | 30.2 | 111 | 13.5 | 50 | 12.7 | 47 | 14.5 | 54 | 2.5 | 9 | 22.6 | 83 | | | | | | | | | | |
| 8315 | ♂ | 27. | 18.6 | 69 | 29.75 | 110 | 28.4 | 105 | 13.25 | 49 | 11.5 | 43 | 10.9 | 40 | 2.1 | 8 | 20.7 | 77 | | | | | | | | | | |
| 8320 | ♂ | 27. | 18.1 | 67 | 29.3 | 109 | 29.1 | 108 | 12.1 | 45 | 12.7 | 47 | 12.4 | 46 | 2.6 | 10 | 20.25 | 75 | | | | | | | | | | |
| 8293 | ♂ | 26.5 | 19.3 | 73 | 30.9 | 117 | 29.5 | 111 | 13.25 | 50 | 12.25 | 46 | 13.6 | 51 | 2.1 | 8 | 21.6 | 82 | 16. | 60 | 14.8 | 56 | 8.8 | 33 | 20. | 75 | 3.8 | 14 |
| 8328 | ♂ | 26.4 | 19.9 | 75 | 32.2 | 122 | 31.5 | 119 | 12.8 | 49 | 12.6 | 48 | 13.1 | 50 | 2.5 | 10 | 22.5 | 85 | | | | | | | | | | |
| 8327 | ♂ | 26.3 | 17.3 | 66 | 30. | 114 | 26. | 99 | 11.85 | 45 | 10.9 | 42 | 12.6 | 48 | 2. | 8 | 20.8 | 79 | | | | | | | | | | |
| 8323 | ♂ | 26. | 17.9 | 69 | 28.25 | 109 | 27.5 | 106 | 13. | 50 | 11.8 | 45 | 12. | 46 | 2.2 | 8 | 20.5 | 80 | | | | | | | | | | |
| 8369 | ♂ | 25.8 | 17.3 | 67 | 30. | 116 | 27.75 | 108 | 12.3 | 48 | 12.6 | 49 | 12. | 47 | 2.5 | 10 | 20.3 | 79 | | | | | | | | | | |
| 8365 | ♂ | 25.5 | 18.8 | 74 | 29.5 | 116 | 29.5 | 116 | 12.25 | 48 | 12.75 | 50 | 13. | 51 | 2.1 | 8 | 21.1 | 83 | | | | | | | | | | |
| 8368 | ♂ | 25.5 | 18.6 | 73 | 29.7 | 116 | 27.5 | 108 | 11.75 | 46 | 11.7 | 46 | 12.2 | 48 | 2.5 | 10 | 20.9 | 82 | | | | | | | | | | |
| 8295 | ♂ | 25.4 | 17.2 | 68 | 28.7 | 113 | 27.3 | 107 | 10.7 | 42 | 11.9 | 47 | 12. | 47 | 2.25 | 9 | 20.4 | 80 | 14. | 55 | 12.6 | 50 | 7. | 28 | 18.6 | 73 | 3.2 | 13 |
| 8343 | ♂ | 25.2 | 17.7 | 70 | 28.4 | 113 | 25.8 | 102 | 12.2 | 48 | 10.5 | 42 | 12.7 | 50 | 2.5 | 10 | 19.75 | 78 | | | | | | | | | | |
| 8314 | ♂ | 25. | 17.7 | 71 | 28.3 | 113 | 25.2 | 101 | 12. | 48 | 10.7 | 43 | 11.9 | 48 | 2.4 | 10 | 19.2 | 77 | | | | | | | | | | |
| 8359 | ♂ | 24.9 | 17.9 | 72 | 28.6 | 115 | 25.9 | 104 | 13.2 | 53 | 10.7 | 43 | 13.4 | 54 | 2.25 | 9 | 20.4 | 82 | | | | | | | | | | |
| 8329 | ♂ | 24.8 | 16.9 | 68 | 28.1 | 117 | 27. | 109 | 11.8 | 48 | 10.7 | 43 | 11.8 | 47 | 1.9 | 8 | 19.5 | 79 | | | | | | | | | | |
| 8318 | ♂ | 24.3 | 17.25 | 71 | 27.1 | 112 | 25.9 | 107 | 13.4 | 55 | 10.4 | 43 | 13. | 54 | 2. | 8 | 19.55 | 80 | | | | | | | | | | |
| 8338 | ♂ | 24.1 | 17.2 | 71 | 28.4 | 118 | 26. | 108 | 14.2 | 59 | 10.5 | 43 | 12.4 | 51 | 2. | 8 | 20. | 83 | | | | | | | | | | |
| 8317 | ♂ | 24. | 17. | 71 | 27.8 | 116 | 26.1 | 109 | 10.9 | 45 | 11.4 | 47 | 11.5 | 48 | 2.4 | 10 | 19.6 | 82 | | | | | | | | | | |
| 8360 | ♂ | 23.6 | 17. | 72 | 27.9 | 118 | 26.5 | 112 | 11.5 | 49 | 11.3 | 48 | 11.5 | 49 | 2. | 8 | 19.2 | 81 | | | | | | | | | | |
| 8331 | ♂ | 23.4 | 15.6 | 67 | 26.3 | 112 | 24.6 | 105 | 10.1 | 43 | 10.9 | 46 | 11.5 | 49 | 2.3 | 10 | 19. | 81 | | | | | | | | | | |
| 8356 | ♂ | 23.25 | 16.4 | 71 | 26.7 | 111 | 25. | 108 | 10.5 | 45 | 11.4 | 49 | 10.8 | 46 | 2.5 | 11 | 19.5 | 83 | | | | | | | | | | |

## TABLE OF MEASUREMENTS OF DUNCAN ISLAND TORTOISES.

| Number | Sex | Straight | | | Curved | | | | Width 2d to 3d marginals | | Height | | | | Height to marginals | | Plastron | | Fore Limb | | Hind Limb | | Axilla to Elbow | | Neck | | Tail | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Length | Width | Per Cent | Length | Per Cent | Width | Per Cent | | Per Cent | Middle | Per Cent | Front | Per Cent | | Per Cent | | Per Cent | | Per Cent | | Per Cent | | Per Cent | | Per Cent | | Per Cent |
| 8299 | ♀ | 27. | 18.9 | 70 | 31.5 | 117 | 30.2 | 112 | 12.25 | 45 | 13.25 | 49 | 12.5 | 46 | 2.1 | 8 | 21.7 | 80 | | | | | | | | | | |
| 8301 | ♀ | 26.5 | 19.8 | 75 | 31.4 | 118 | 31.1 | 117 | 12.25 | 46 | 13.4 | 51 | 12.5 | 47 | 3.1 | 12 | 21.2 | 80 | | | | | | | | | | |
| 8298 | ♀ | 25.8 | 17.3 | 67 | 28.7 | 111 | 25.4 | 100 | 13.2 | 51 | 10.1 | 39 | 12.1 | 47 | 2.3 | 9 | 20.2 | 78 | | | | | | | | | | |
| 8345 | ♀ | 24.25 | 18.2 | 75 | 27.7 | 114 | 27.9 | 115 | 11.5 | 47 | 11.9 | 49 | 10.8 | 45 | 2.4 | 10 | 19.9 | 82 | | | | | | | | | | |
| 8355 | ♀ | 23.4 | 17. | 73 | 26.1 | 112 | 26. | 111 | 12.6 | 54 | 9.8 | 42 | 10.5 | 45 | 1.7 | 7 | 18.8 | 80 | | | | | | | | | | |
| 8297 | ♀ | 23.2 | 17.9 | 77 | 27.8 | 120 | 27.5 | 119 | 11. | 47 | 11.5 | 50 | 9.9 | 43 | 2.2 | 9 | 19.5 | 84 | | | | | | | | | | |
| 8294 | ♀ | 22.8 | 17.9 | 79 | 26.5 | 116 | 27.6 | 121 | 12.1 | 53 | 11.5 | 50 | 10.5 | 46 | 2.1 | 9 | 19.4 | 85 | | | | | | | | | | |
| 8371 | ♀ | 22.75 | 16.7 | 73 | 27. | 119 | 26.3 | 111 | 10.6 | 47 | 11.6 | 51 | 10.25 | 45 | 2.3 | 10 | 18.9 | 83 | | | | | | | | | | |
| 8348 | ♀ | 22.2 | 16.7 | 75 | 25.9 | 117 | 26.2 | 118 | 11.2 | 50 | 11.25 | 51 | 9.5 | 43 | 2.25 | 10 | 18.5 | 83 | | | | | | | | | | |
| 8340 | ♀ | 22.2 | 16.15 | 73 | 25.8 | 116 | 25.3 | 114 | 11. | 50 | 10.8 | 49 | 10.5 | 47 | 2.1 | 9 | 18. | 81 | | | | | | | | | | |
| 8341 | ♀ | 22. | 16.75 | 76 | 26. | 118 | 26.2 | 119 | 11.3 | 51 | 11.1 | 50 | 9.7 | 44 | 1.8 | 8 | 19. | 86 | | | | | | | | | | |
| 8291 | ♀ | 22. | 15.1 | 69 | 25. | 114 | 23.75 | 108 | 10.6 | 48 | 10.4 | 47 | 95. | 43 | 2.25 | 10 | 17.5 | 80 | 11.6 | 53 | 11.2 | 51 | 6.8 | 31 | 14.6 | 66 | .4 | 2 |
| 8321 | ♀ | 21.9 | 16.25 | 74 | 25.3 | 116 | 25.5 | 116 | 10.8 | 49 | 10.8 | 49 | 9.5 | 43 | 2.2 | 10 | 18.25 | 83 | | | | | | | | | | |
| 8339 | ♀ | 21.9 | 15.8 | 72 | 24.7 | 113 | 24.6 | 112 | 10.2 | 47 | 10.4 | 47 | 10. | 46 | 2. | 9 | 17.5 | 80 | | | | | | | | | | |
| 8335 | ♀ | 21.8 | 15.7 | 72 | 25.25 | 116 | 24.4 | 112 | 10.25 | 47 | 10.5 | 48 | 9.7 | 44 | 2.3 | 11 | 18.2 | 83 | | | | | | | | | | |
| 8336 | ♀ | 21.7 | 16.2 | 75 | 25.1 | 116 | 25.2 | 116 | 11.5 | 53 | 10. | 46 | 10. | 46 | 2. | 9 | 17.7 | 82 | | | | | | | | | | |
| 8361 | ♀ | 21.6 | 15.3 | 71 | 23.7 | 110 | 23.6 | 109 | 10.25 | 47 | 10. | 46 | 9.7 | 45 | 2.1 | 10 | 17.5 | 81 | | | | | | | | | | |
| 8354 | ♀ | 21.5 | 16. | 74 | 24.5 | 114 | 25. | 116 | 10.5 | 49 | 10.1 | 47 | 9. | 47 | 1.75 | 8 | 16.75 | 78 | | | | | | | | | | |
| 8307 | ♀ | 21.5 | 15.2 | 71 | 25.6 | 119 | 23.6 | 110 | 10.6 | 49 | 10. | 46 | 8.9 | 41 | 1.8 | 8 | 18.4 | 86 | | | | | | | | | | |
| 8324 | ♀ | 21.5 | 15.2 | 71 | 24.2 | 113 | 24. | 112 | 12.1 | 56 | 9.2 | 43 | 9.5 | 44 | 1.75 | 8 | 17.6 | 82 | | | | | | | | | | |
| 8326 | ♀ | 21.4 | 16. | 79 | 25.3 | 118 | 24.8 | 116 | 9.7 | 45 | 10.8 | 50 | 9.3 | 43 | 2.25 | 11 | 18. | 84 | | | | | | | | | | |
| 8302 | ♀ | 21.4 | 15.7 | 73 | 24.7 | 115 | 24.2 | 113 | 9.8 | 46 | 10.3 | 48 | 8.75 | 41 | 2.1 | 10 | 17.7 | 82 | | | | | | | | | | |
| 8366 | ♀ | 21.4 | 15.5 | 72 | 23.6 | 110 | 24.3 | 114 | 10.3 | 48 | 9.7 | 45 | 9.3 | 43 | 1.7 | 8 | 17. | 80 | | | | | | | | | | |
| 8303 | ♀ | 21.3 | 15.6 | 73 | 25. | 117 | 24. | 113 | 10. | 47 | 10.2 | 48 | 9.25 | 43 | 2.25 | 11 | 17.6 | 83 | | | | | | | | | | |
| 8372 | ♀ | 21.3 | 15.25 | 72 | 24.8 | 112 | 22.8 | 107 | 10.2 | 48 | 10. | 47 | 8.5 | 40 | 2.3 | 11 | 16.7 | 78 | | | | | | | | | | |
| 8304 | ♀ | 21.2 | 16. | 75 | 25.4 | 119 | 25.4 | 119 | 10.2 | 48 | 10.8 | 51 | 9.9 | 47 | 2.25 | 11 | 17.7 | 82 | | | | | | | | | | |

TABLE OF MEASUREMENTS OF DUNCAN ISLAND TORTOISES—Continued.

| | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8342 | ♀ | 21.2 | 15.1 | 71 | 24.2 | 114 | 23.8 | 112 | 9.7 | 46 | 9.9 | 47 | 9.5 | 45 | 1.8 | 8 | 17.5 | 82 | | | | | | | | |
| 8347 | ♀ | 21.2 | 14.9 | 70 | 24. | 113 | 23.5 | 111 | 10.1 | 48 | 9.7 | 46 | 8.8 | 42 | 1.7 | 8 | 16.5 | 78 | | | | | | | | |
| 8300 | ♀ | 21.1 | 15.2 | 72 | 23.7 | 112 | 23.4 | 111 | 10.5 | 50 | 9.9 | 47 | 8.7 | 41 | 1.75 | 8 | 17. | 81 | 11.6 | 55 | 10.4 | 49 | 5.2 | 25 | 13.2 | 63 | 1.4 | 7 |
| 8292 | ♀ | 21. | 16.2 | 77 | 25.1 | 120 | 25.9 | 123 | 9.2 | 44 | 11.25 | 54 | 9.8 | 47 | 2. | 10 | 17.5 | 83 | | | | | | | | |
| 8310 | ♀ | 21. | 16. | 76 | 25.2 | 120 | 26.3 | 126 | 11. | 50 | 11.4 | 54 | 9.8 | 47 | 2.1 | 10 | 17.4 | 83 | 12. | 57 | 10.2 | 48 | 6.6 | 31 | 13.2 | 63 | 2. | 9 |
| 8337 | ♀ | 21. | 15.1 | 72 | 24.1 | 115 | 23.5 | 112 | 10.25 | 49 | 9.9 | 47 | 9. | 43 | 1.6 | 8 | 17.1 | 81 | | | | | | | | |
| 8325 | ♀ | 21. | 15. | 71 | 24.6 | 117 | 24. | 114 | 9.9 | 47 | 10.6 | 50 | 9.5 | 45 | 2. | 10 | 16.75 | 80 | | | | | | | | |
| 8311 | ♀ | 20.8 | 16.4 | 79 | 25. | 120 | 25.6 | 123 | 11.1 | 53 | 11. | 53 | 10. | 48 | 2. | 10 | 17.7 | 85 | | | | | | | | |
| 8362 | ♀ | 20.7 | 15.1 | 73 | 23. | 111 | 23.9 | 116 | 9.5 | 46 | 9.8 | 47 | 9.5 | 46 | 1.8 | 9 | 16.5 | 80 | | | | | | | | |
| 8376 | ♀ | 20.5 | 15.6 | 71 | 23.7 | 116 | 24. | 117 | 10.8 | 53 | 9.4 | 46 | 9. | 44 | 1.8 | 9 | 17.4 | 85 | | | | | | | | |
| 8316 | ♀ | 20.5 | 15.6 | 76 | 23.4 | 114 | 24.8 | 121 | 9.4 | 46 | 9.75 | 48 | 8.5 | 41 | 1.6 | 8 | 17.1 | 83 | | | | | | | | |
| 8350 | ♀ | 20.5 | 15.2 | 74 | 24. | 117 | 24. | 117 | 9.5 | 46 | 8.8 | 43 | 8.5 | 41 | 2.1 | 10 | 16.7 | 81 | | | | | | | | |
| 8308 | ♀ | 20.5 | 15. | 71 | 24. | 117 | 23.7 | 116 | 10.1 | 49 | 10.8 | 50 | 8.7 | 42 | 1.9 | 9 | 17. | 83 | 12.3 | 60 | 12. | 59 | 6.4 | 31 | 12.4 | 60 | 2. | 10 |
| 8333 | ♀ | 20.5 | 15. | 71 | 23.6 | 115 | 21.9 | 107 | 10.4 | 51 | 9.6 | 47 | 8.2 | 40 | 2.4 | 12 | 16. | 78 | | | | | | | | |
| 8306 | ♀ | 20.5 | 14.5 | 71 | 23.1 | 113 | 22.5 | 110 | 10.8 | 53 | 9.45 | 46 | 9.4 | 46 | 1.75 | 9 | 16.7 | 81 | | | | | | | | |
| 8309 | ♀ | 20.4 | 15.7 | 77 | 24.5 | 120 | 24.4 | 120 | 9.1 | 45 | 10.6 | 52 | 9.8 | 48 | 2. | 10 | 17.5 | 86 | | | | | | | | |
| 8363 | ♀ | 20.4 | 15.4 | 75 | 23.2 | 114 | 22.5 | 110 | 10.8 | 53 | 8.8 | 43 | 8.9 | 44 | 1.6 | 8 | 17.4 | 85 | | | | | | | | |
| 8322 | ♀ | 20.4 | 15.2 | 75 | 24.9 | 122 | 24.7 | 121 | 9.5 | 47 | 10.3 | 50 | 9.1 | 45 | 1.8 | 9 | 17.2 | 84 | | | | | | | | |
| 8334 | ♀ | 20.4 | 15. | 74 | 23. | 113 | 22.7 | 111 | 9.7 | 48 | 9.2 | 45 | 9.2 | 45 | 2.3 | 11 | 16.5 | 81 | | | | | | | | |
| 8344 | ♀ | 20.4 | 14.3 | 70 | 23.5 | 115 | 23.1 | 113 | 9.8 | 48 | 9.7 | 48 | 9. | 44 | 2.1 | 10 | 16.6 | 81 | | | | | | | | |
| 8370 | ♀ | 20.2 | 15. | 79 | 23.75 | 118 | 23.2 | 115 | 10.4 | 51 | 10.8 | 53 | 9.4 | 47 | 1.8 | 9 | 17.7 | 88 | | | | | | | | |
| 8332 | ♀ | 20.1 | 15.25 | 76 | 23.8 | 118 | 23.6 | 117 | 9.5 | 47 | 10.4 | 52 | 8.4 | 42 | 2.1 | 10 | 16.2 | 81 | | | | | | | | |
| 8352 | ♀ | 20.1 | 14.9 | 74 | 23.3 | 116 | 23.5 | 117 | 10.5 | 52 | 9.6 | 48 | 9.1 | 45 | 2. | 10 | 17.2 | 86 | | | | | | | | |
| 8373 | ♀ | 19.9 | 15. | 75 | 23.5 | 118 | 22.2 | 112 | 9.6 | 48 | 9.7 | 49 | 8.5 | 43 | 2. | 10 | 16.7 | 84 | | | | | | | | |
| 8312 | ♀ | 19.8 | 14.6 | 74 | 22.4 | 113 | 22.9 | 116 | 10.2 | 52 | 8.9 | 45 | 8.3 | 42 | 1.6 | 8 | 16.2 | 82 | | | | | | | | |
| 8346 | ♀ | 19.7 | 14.75 | 75 | 23. | 117 | 23.3 | 118 | 10. | 51 | 10. | 51 | 10.3 | 52 | 2.2 | 11 | 16.9 | 86 | | | | | | | | |
| 8357 | ♀ | 19.7 | 14.1 | 72 | 21.75 | 110 | 20.25 | 103 | 10. | 51 | 8.75 | 44 | 8.2 | 42 | 1.9 | 10 | 16. | 81 | | | | | | | | |
| 8375 | ♀ | 19.6 | 15 | 76 | 22. | 112 | 23.3 | 119 | 9.7 | 49 | 8.2 | 42 | 8. | 41 | 1.75 | 9 | 16.5 | 84 | | | | | | | | |
| 8305 | ♀ | 19.6 | 14.3 | 73 | 23.2 | 118 | 22.5 | 115 | 10. | 51 | 9.4 | 48 | 8.5 | 43 | 1.75 | 9 | 16.4 | 84 | | | | | | | | |
| 8319 | ♀ | 19.6 | 14.2 | 72 | 22.6 | 115 | 22.3 | 114 | 9.35 | 48 | 9.3 | 47 | 8.2 | 42 | 1.45 | 7 | 16.2 | 83 | | | | | | | | |
| 8353 | ♀ | 19.5 | 14. | 72 | 22. | 113 | 21.2 | 109 | 9.1 | 47 | 8.6 | 44 | 7.9 | 41 | 1.95 | 10 | 15.25 | 78 | | | | | | | | |
| 8367 | ♀ | 19.2 | 13.8 | 72 | 21.6 | 112 | 21.7 | 113 | 9.2 | 48 | 9.2 | 48 | 8. | 42 | 1.6 | 8 | 14.9 | 78 | | | | | | | | |
| 8349 | ♀ | 18.7 | 13.7 | 73 | 21.5 | 115 | 20.1 | 108 | 9.3 | 50 | 8.1 | 43 | 8. | 43 | 1.5 | 8 | 15.7 | 84 | 9.8 | 52 | 9.2 | 49 | | | 12. | 64 | 2. | 11 |
| 8374 | ♀ | 18.7 | 12.8 | 68 | 21.2 | 113 | 18.9 | 101 | 9.2 | 49 | 8.1 | 43 | 7.4 | 39 | 1.9 | 10 | 15. | 80 | | | | | | | | |
| 8330 | ♀ | 18.4 | 13.8 | 75 | 21.3 | 116 | 21. | 114 | 8.75 | 47 | 9. | 49 | 8.6 | 47 | 1.9 | 10 | 16.1 | 87 | | | | | | | | |

*General remarks.*—The Duncan Island tortoise is one of the smaller species. The size is by no means proportionate to the age, if one may judge from the ossification of the points of growth in the bones and the loss of striation of the plates of the carapace. Some of the large males seem to be quite young, and some of the oldest females are very small. The large males are most similar in shape to those of Abingdon. There is much variation in shape in both sexes, as is shown in the tables and charts of measurements and the photographs of specimens. A number of specimens have the pectoral plates not meeting on the midline.

An egg (No. 8423) from Duncan Island measures 2.34x 2.30 inches. It was found lying on the surface of the ground in December, 1905.

*Field Notes*—Dec. 1, 1905.—Sailed for Duncan Island in the morning, and anchored off the northeast side of the island at dusk. Light winds all day.

Dec. 2, 1905.—Skinned two turtles and a tortoise which Hunter brought down from the edge of the crater. Beck went ashore looking for tortoises, and found twelve, which he tied up. Monday we start to skin them and get them to the vessel. I shall clear things up somewhat before going on Tuesday to camp with Beck. Beck found the skull of a tortoise in good condition, and brought it down.

Dec. 4, 1905.—Beck went into camp today on the top of the crater. I go up tomorrow to skin tortoises. Stewart, Hunter, and Ochsner brought down a tortoise each today; two males and a female.

Dec. 5, 1905.—Finished the skinning of the three tortoises brought down yesterday. All were very fat, and had very long necks for their size. The female had eggs in yolk and one nearly developed.

Dec. 6-9, 1905.—I was in camp skinning and carrying tortoises. We had our camp in a valley near the top of the island just south of the large crater. The country is very rough, and covered in most places with thick brush and thorn bushes. No tortoises were found in the crater, but Beck saw the tracks of one there. We found several old males, which were brought down alive, and which will be kept if possible.

The tortoises have lots of moss in their stomachs and a kind of thick grass that, when dried, looks somewhat like straw. They also feed largely on cactus. I was able to get the temperature of some, and found them to be warm, but they happened to be in the sun. Some measurements were lost because my note book got wet. It is not the best kind of country for books or tools of any description. We have got about twenty-nine tortoises on board up to date and have several more tied up ashore which we expect to get next week. The tortoises here all have very dark livers, while on Indefatigable all were very light-colored and fat. The Duncan tortoises are all very fat except the old males, which had no fat or very little. I am going back the first thing Monday morning to work on tortoises again.

Dec. 11-16, 1905.—Camped in the central part of Duncan, working on tortoises. We have been here two weeks now, and probably have about eighty tortoises. They were common along the southern and western slopes of the island, where most of them were taken. All the females had eggs in yolk form, and one with hard shell was found. Mr. Beck found two eggs exposed on the ground. We kept them to blow, though both were cracked. We had a light rain all night on the twelfth, and the tortoises came out from the brush to the water holes. Those we found after this were mostly filled with water, which seemed to be all through the body, and would come out as soon as the plastron was cut into. The stomachs contained cactus, grass and moss. Some of the old males taken would stretch out their necks and, with mouths wide open, would have a somewhat fierce expression, but they made no attempt to bite. Several pictures were taken—one of an old male which was holding a small female by the hind leg. The old tortoises had lichen growing on their backs and at a short distance looked exactly like blocks of lava, which were covered with the same growth. I shall have to spend a few days now getting the tortoises put in shape. With such a grand rush they could not well be in the best condition. We have to go to Conway Bay tomorrow, and from there to Jervis and James.

Jan. 30, 1906.—The Duncan tortoises are doing well, and eat a good portion of cactus. They are very slow and delib-

erate in their movements. They take very small bites, scraping the inside of the cactus with their horny jaws.

July 11, 1906.—One of the old Duncan tortoises died today. He was full of sores (abscesses?) and had something the matter with his feet, as the skin nearly fell off them. The lungs were very dry and full of hard lumps. The skull was broken and several other bones were cracked or very weak. Altogether, he was in a bad state, whatever was the matter.

August 14, 1906.—Anchored off Duncan about ten in the morning. I went ashore for lizards, while Beck went in after tortoises.

August 15, 1906.—I went down into the large crater at the north end of the island. The floor of the crater is 450 feet above the sea level, and is composed of red loam covered with large thorn bushes and old stumps. The vegetation is thickest around the edge, while the central portion is almost bare. I saw old signs of tortoises, but lizards were the only reptiles seen in the crater. Beck got seven tortoises down to the vessel, some alive and some partly skinned. We shall have to clean up the mess tomorrow. Tortoises still are abundant on Duncan. We run across them while hunting for other things. Former collectors could not have covered very much country, if they could say they doubted whether more than two or three yet remained on the island. Beck found that one female contained large eggs with soft white shell nearly ready to lay. He brought these down, and I will see if it is possible to preserve them. We expect to sail for Vilamil early in the morning.

Sept. 8, 1906.—The large male tortoise we took off Duncan during our first visit died today.

Oct. 4, 1906.—A male Duncan tortoise died on board today.

## **Testudo hoodensis** Van Denburgh

Hood Island Tortoise

Plates 52 to 55.

*Testudo hoodensis* Van Denburgh, Proc. Cal. Acad. Sci. (4), I, 1907, p. 3; Siebenrock, Zool. Jahrb., Suppl. X, 3 1909, p. 535.

*Type specimen.*—California Academy of Sciences No. 8121. Male. Straight length 22.2 inches. Taken on Hood Island, by Joseph R. Slevin and E. S. King, June 27, 1906.

*Distribution.*—This tortoise is known only from Hood Island.

*Material.*—The Academy has the skins and bones of one male and two female specimens, one extra skull and some fragments. The Honorable Walter Rothschild writes me that there is in his museum at Tring a carapace without plastron which he refers to this species.

*Diagnosis.*—No nuchal; gulars paired; fourth cervical vertebra biconvex; front of carapace high, little lower than middle, height at nuchal notch 42 to 49% of straight length; difference between percentages of heights at third vertebral and at nuchal notch less than 9 (2 to 6); carapace saddle-shaped, narrow anteriorly, width at margin of junction of second and third marginals not more than 54% (45%); first marginals not greatly enlarged, not much everted, their ventral surfaces not vertical, their most prominent points separated by less than 30% (20%); length over curve not more than 123% (111 to 123%); greater than width over curve; vertical distance from lower surface of plastron to lower edge of lateral marginals great, 10 to 12%; general size rather small, straight length, 22.2 inches; plastron long, median length 89 to 93%; plates striated, central portions of vertebrals and costals much elevated; pectoral plates forming a suture on median line; lower jaw and throat marked with yellow.

## TABLE OF MEASUREMENTS OF HOOD ISLAND TORTOISES.

| Number | Sex | Straight | | | Curved | | Height | | | Width 2d to 3d marginals | | Height | | Width | | Height | | Axilla to Elbow | | Neck | | Tail | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Length | Width | Per Cent | Length | Per Cent | Middle | Per Cent | Front | | Per Cent | Height to marginals | Per Cent | Plastron | Per Cent | Fore Limb | Per Cent | Hind Limb | Per Cent | | Per Cent | | Per Cent |
| 8121 | ♂ | 22.2 | 17.5 | 77 | 27. | 122 | 24.8 | 112 | 10. | 45 | 11.2 | 50 | 10.3 | 45 | 2.75 | 12 | 19.7 | 89 | 12.5 | 56 | 11.5 | 52 | 6. | 27 | 13. | 59 | 1.5 | 7 | 7 |
| 8122 | ♀ | 21. | 16.2 | 77 | 25.75 | 123 | 24.25 | 115 | 9.5 | 45 | 10.75 | 51 | 10.3 | 49 | 2.5 | 12 | 19.5 | 93 | 11.5 | 55 | 10.5 | 50 | 7. | 33 | 11. | 52 | 1.5 | | |
| 8123 | ♀ | 19.75 | 14.75 | 74 | 22. | 111 | 21.5 | 109 | 8.75 | 44 | 9.4 | 48 | 8.3 | 42 | 2. | 10 | 17.5 | 89 | | | | | | | | | | | |

*General remarks.*—The Hood Island tortoise probably never attained great size. None of our specimens is fully adult, but I should judge that an adult would not be larger than a Duncan tortoise. It is probable that the Charles Island and the Hood Island tortoises were very similar in shape, but the Hood Island ones are narrower than the specimens which are thought to have originated in Charles Island.

*Field Notes*—Hood Island was reached September 24, 1905. Various parts of the island were explored during this visit which ended October 2. On September 27, Mr. Beck found some fragments of tortoise bones on the western end of the island. They were lying on the ground among the lava blocks and were exposed to the sun. These fragments were the only signs of tortoises. Hood Island was visited again from January 31 until February 7, 1906. A piece of tortoise carapace and some old droppings were found near the top of the island.

On June 23, 1906, the anchor was again dropped in Gardner Bay. Exploration revealed no evidence of tortoises until June 26, when, as Mr. Slevin records: [Mr. Ochsner and I] went into the interior at the east end of the island and picked up some lizards, which are abundant everywhere. We reached an elevation of about 300 feet and, in a grove of cactus trees about two miles inland from Gardner Bay, ran on to a tortoise. The country here is very brushy, and the ground is covered with small rocks, so that no trails can be seen anywhere. The tortoise was lying in the shade of a large cactus at the edge of a thick patch of brush. It appears to be an adult female. No other signs were encountered and it is only great luck to find a tortoise, as there are no trails to follow.

June 27, 1906.—Went again after tortoises to the same country we visited yesterday. Mr. King had the good fortune to find a tortoise, this time in the thick brush near the edge of a large open area. It appears to be an adult female. Beck went over to the northwest end of the island and says he got into good tortoise country. He saw no signs of living tortoises but found some good bones.

June 28, 1906.—Went in after tortoises again but failed to find any. We however found a very fresh sign; but the brush was so thick that we could not find the tortoise, even after a

long search. Examined some fresh droppings, and found it contained the red bark of the cactus and coarse grass. The tortoises evidently feed poorly, as the goats, which run thick all over the island, keep the cactus eaten up as soon as it falls.

June 29, 1906.—Still searching for tortoises but find no signs.

June 30, 1906.—Went in again after tortoises. No luck.

July 2, 1906.—Beck was in after tortoises, and found one small one about four miles inland from Gardner Bay. Evidently they have been well cleaned out.

### **Testudo elephantopus** Harlan

Charles Island Tortoise

Plates 55 and 56.

? *Testudo nigra* Quoy & Gaimard, Voy. Uranie et Physic., Zool., 1824, p. 172, pl. XI; Duméril & Bibron, Erpét Génér., II, 1835, p. 115; Wiegmann, N. Acta Leop.—Carol., XVII, 1835, p. 118, pl. XIII; Strauch, Mém. Ac. St. Petersb. (7), V. No. 7, 1862, p. 85.

? *Testudo californiana* Quoy & Gaimard, Bull. Sci. Nat., I, 1824, p. 90, pl. XI [substitute name].

*Testudo elephantopus* Harlan, Journ. Ac. Nat. Sci. Phila., V, 1827, p. 284, pl.—; Harlan, Medical & Physical Researches, 1835, p. 190, pl.; Jackson, Journ. Boston Soc. Nat. Hist., I, 1837, p. 443, pls. X-XI.

? *Testudo indica* Gray, Syn. Rept., 1831, p. 9 (part).

*Testudo galapagoensis* Baur, Am. Nat., XXIII, Dec. 1889 [1890], p. 1044; Günther, Nov. Zool., IX, 1902, p. 184, pls. XVI-XXI; Heller, Proc. Washington Acad. Sci., V, 1903, p. 53; Siebenrock, Zool. Jahrb., Suppl. X, 3, 1909, p. 533.

*Type specimens.—?Testudo nigra*: Paris Museum. Young. Straight length about 10½ inches. Presented to M. de Freycinet by Captain Meek of the "Boston Eagle" while the "Uranie" and "Physicien" were in the Sandwich Islands. It was said to have come from California.

*Testudo elephantopus*: Academy of Natural Sciences of Philadelphia. Probably No. 366. Young. Curved length 21.6 inches. Taken in the Galapagos Islands.

*Testudo galapagoensis*: Boston Society of Natural History. Skeleton of adult male. Curved length 45 inches. Taken, probably on Charles Island, by Captain John Downes, in 1833, and presented in June, 1834.

*Distribution.*—This tortoise formerly was abundant on Charles Island to which it was confined. It probably is now extinct.

*Material.*—The Academy's collection contains no specimens of the Charles Island tortoise. In addition to the skeleton in the Boston Society of Natural History, three other specimens have been referred to this species by Dr. Günther. These are the carapace of an adult male in the Rothschild Museum at Tring, England, a female in the Harvard Museum of Comparative Zoology, and probably a male in the Peabody Academy of Science in Salem, Massachusetts.

*Diagnosis.*—No nuchal; gulars paired; third[1] cervical vertebra biconvex; front of carapace fairly high; carapace inclining toward the saddle-shape, broad, depressed, flat-backed, rather broad anteriorly; first marginals not much enlarged, not everted, their ventral surfaces not vertical, their most prominent points not widely separated; length over curve not more than 125% (120-125%), less than width over curve; vertical distance from lower surface of plastron to lower edge of lateral marginals great; general size large, straight length 37.5 inches; plastron moderate, median length 75 to 80%; plates generally smooth; pectorals forming a suture on median line; eighth marginal large with a long superior border.

*General Remarks.*—The Charles Island tortoise was closely related to that of Hood Island, but was of a somewhat broader, and perhaps smoother type. No tortoise has been taken in Charles Island for many years and there can be little doubt this race is extinct.

Neither Mr. Slevin nor any other member of the Expedition found anything to indicate the presence of tortoises on Charles Island. Not even a bit of bone was found, although much time was spent in searching on various parts of the island, as the following extracts from Mr. Slevin's notes show:

*Field Notes*—Oct. 4, 1905.—Went ashore at Post Office Bay and worked towards the interior. Found animal life of every description scarce. No signs of tortoises, nor any bones, were seen.

Oct. 5-6, 1905.—Ashore at the northeast end of the island. No reptiles seen except *Tropidurus* and geckos.

[1]This probably is an abnormal, individual variation. The same condition has been described in the type of *T. becki* in which the fourth normally is biconvex as in the other races.

Oct. 7, 1905.—Went ashore at Black Beach and followed along the road, which is more properly a trail, quite a distance inland. I saw no reptiles of any description except geckos. This part of the island is thickly wooded, and has no large lava-fields; more green vegetation and soil.

Oct. 9, 1905.—Went ashore at Black Beach and worked into the interior up to some springs south of the highest peak.

Oct. 10, 1905.—Worked up to the top of the crater on the highest mountain, but saw no signs of any reptiles whatever. It rained quite often near the summit; so I worked down into a valley to the south, and found clear open country with plenty of cattle trails and everything green. Worked down toward the coast with the ocean on the south side in view. No tortoise bones were found. Nothing has been seen by any of the party.

Oct. 11, 1905.—Worked toward the interior southwest of Black Beach. The country is fairly open. Saw no sign of any reptiles except geckos.

Oct. 12, 1905.—Worked into the interior to see if I could find any lizards or snakes. Found fine open country with everything green, wild cattle, hogs, etc. Found no trace of any reptiles whatever.

Feb. 26, 1906.—Went ashore at Cormorant Bay.

Feb. 27-Mar. 2, 1906.—Black Beach. No reptiles of any description, other than geckos, were seen by any of the party during their hunting trips on this part of the island.

May 15-16, 1906.—Went in from Black Beach camping to shoot cattle and lay in a supply of meat. Stayed two days, and brought down two loads.

May 17, 1906.—Stopped about an hour at Cormorant Bay.

May 23, 1906.—Collected near Black Beach.

May 24-June 1, 1906.—Stayed in camp getting beef.

June 2, 1906.—Went up to the highest mountain on the island, and climbed to the top. This tramp, like a long trip around the south side of the island on the 25th of May, showed no signs of any reptiles whatever.

June 4, 1906.—Went up the trail to about 600 feet elevation, and collected a few more geckos.

## Testudo darwini Van Denburgh

James Island Tortoise

Plates 56 to 63.

*Testudo darwini* Van Denburgh, Proc. Cal. Acad. Sci. (4), I, 1907, p. 4; Siebenrock, Zool. Jahrb., Suppl. X, 3, 1909, p. 533.

*Type specimen.*—California Academy of Sciences No. 8108. Adult male. Straight length 38 inches. Taken on James Island, by R. H. Beck and Joseph R. Slevin, July 31, 1906.

*Distribution.*—This tortoise seems now to be confined to the less accessible parts of James Island. It formerly was very abundant, but seems now to be very near extinction.

*Material.*—Although this tortoise was taken from the Galapagos Islands in great numbers by vessels which visited them in early days, no specimen of it seems to have been preserved in any museum until the recent expedition secured five for the Academy.

*Diagnosis.*—No nuchal; gulars paired; fourth cervical vertebra biconvex; carapace high, elongate, somewhat dome-shaped but high in front; posterior declivity beginning about middle of third vertebral; height at nuchal notch more than 41% (42 to 45%) of straight length; difference between percentages of height at third vertebral and at nuchal notch in male more than 9 (10 to 14); carapace not saddle-shaped, width at margin of junction of second and third marginals 48 to 58%; width over curve in male not greater than length over curve; vertical distance from lower surface of plastron to lower edge of lateral marginals moderately great, 7 to 9%; general size large, straight length 38 inches; shell heavy; pectoral plates forming a suture on median line; eighth marginal not reduced; the sum of the measurements of the length over curve, length of plastron, height at nuchal notch, and height at third vertebral, equals or exceeds the sum of the measurements of the straight length, straight width, and width over curve; jaws and throat black marked with yellow.

TABLE OF MEASUREMENTS OF JAMES ISLAND TORTOISES.

| Number | Sex | Straight | | | Curved | | | Height | | | Height to marginals | | Plastron | | Fore Limb | | Hind Limb | | Axilla to Elbow | | Neck | | Tail | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Length | Width | Per Cent | Length | Per Cent | Width | Per Cent | Width 2d to 3d marginals | Per Cent | Middle | Per Cent | Front | Per Cent | | Per Cent | | Per Cent | | Per Cent | | Per Cent | | Per Cent |
| 8109 | ♂ | 40.25 | 29.5 | 73 | 50.25 | 125 | 50.5 | 125 | 19.5 | 48 | 22.4 | 56 | 17. | 42 | 2.8 | 7 | 30.75 | 76 | 20.8 | 52 | 18.4 | 46 | 12. | 30 | 24.8 | 62 | 3.8 | 9 |
| 8108 | ♂ | 38. | 28. | 74 | 49. | 129 | 46. | 122 | 21. | 55 | 20.87 | 55 | 17.12 | 45 | 3.4 | 9 | 32.25 | 85 | 18. | 47 | 16.4 | 43 | | | 21.2 | 56 | 6.8 | 18 |
| 8107 | ♂ | 21. | 16.5 | 79 | 26.5 | 126 | 25. | 119 | 10.75 | 51 | 11.25 | 54 | 6.75 | 32 | 2.3 | 11 | 18. | 86 | | | | | | | | | | |
| 8106 | ♀ | 30. | 23. | 77 | 37.75 | 126 | 38.75 | 129 | 17.5 | 58 | 17. | 57 | 12.5 | 42 | 2.6 | 9 | 25.5 | 85 | | | | | | | | | | |
| 8105 | ♀ | 25.75 | 18.5 | 72 | 30.75 | 119 | 29.5 | 114 | 14.5 | 56 | 13. | 50 | 11.25 | 44 | 2. | 8 | 21.5 | 83 | | | | | | | | | | |

*General remarks.*—The James Island tortoise is a very large, heavy, thick-shelled species which resembles most closely the tortoise of Jervis Island and the *Testudo vicina* of southern Albemarle. It is somewhat intermediate in shape between the saddle-backed and dome-shaped races. The front of the carapace is high, but the middle of the back rises still higher. There is but little narrowing of the front of the carapace.

*Field Notes.*—December 26, 1905.—Went down the coast to a place which the Captain says is marked in his epitome as Adam's Cove. Beck and Williams went inland to camp and look for tortoises.

Jan. 2, 1906.—Mr. Beck returned on the 29th from a trip to the interior. He reports stopping at the camp where the hunters for tortosies encamped, and says there were bones scattered all about. He collected some of the best specimens, which will be packed in a box. Williams says he saw an old piece of dung at the same place. No fresh signs of tortoises have been seen by any of the party so far.

July 27, 1906.—Sailed from Seymour early in the morning and anchored off the coast of the east end of James Island near Bartholomew. The country presents a very desolate appearance. It is all fresh lava with a few cacti and some brush. Intend to go in after tortoises tomorrow.

July 28, 1906.—Went inland for tortoises. Followed up a valley toward Bartholomew Island, and found the brush and cactus thicker as we got higher. I saw no fresh signs of tortoises, but Beck says he saw some about three weeks old. He also picked up a few old bones.

July 30-August 4, 1906.—Went in after tortoises about five miles northwest of Sullivan Bay. The country is extremely rough—the worst we have encountered since we arrived in the islands. The lava-flows are all comparatively recent, and many places have no vegetation whatever. There is a valley opposite our anchorage which runs into the interior, and is fairly thick with cactus, small trees, and shrubs. We went up this valley about a mile, and saw our first signs of tortoises. There is no earth whatever here; everything is lava, and it is impossible to do any trailing. King, Beck and I looked over the surrounding country for three or four hours. We saw fresh signs, but found no tortoises. I returned to the ship, while

Beck and King went farther up to camp. When I went in to the camp the next day, Beck had found two large male tortoises about five miles up the valley, and in better, or very good, tortoise country. We found plenty of earth and cactus here and everything in favor of finding tortoises. King had one of the males partly skinned, so I helped him finish it, and we brought it out to camp. Beck went over toward the main mountain, and covered lots of country, finding two more males and a female. He went over the next day and skinned the female and another small one which he found on the way, and, with the assistance of Ochsner and Hunter, who came in to help us carry, brought them to the camp. King and I took the first male, which we had skinned, part way down to the vessel. The country was so rough and hard to get over that our shoulders became so sore that we could not hold the tortoise up any longer, so had to leave him in order to get to the beach by dark. The rest of the party, who were to help us out, missed us on the way, so King and I had to go it alone. They found the tortoise on the trail and, carrying it the rest of the way, reached the beach just at dusk. These tortoises have the heaviest shells and bones of any taken by us. The old males were not black (as Porter described them) but the females seem to be quite black. They are all very fat, more so than any we have seen yet. The fat is of a rich yellow color and looks almost like butter. The two males taken are somewhat unlike in shape. The other two males Beck found are far over toward Jervis Island, and it will be impossible for us to get them out. It was very difficult to get out the ones we did. No wonder people don't find tortoises on James! King got the measurements as well as possible, but it is impossible to get accurate measurements for the reason that a tortoise can throw a person in any direction he pleases with one of his legs. I got the measurements of the second male. Beck skinned the females and no measurements were taken. Beck found that these females contained large yolks, but there were no signs of shell on any of the eggs as yet. We saw no signs of any nests, so probably the breeding season commenced during June and July.

August 6, 1906.—Sailed for James Bay, and straightened up things on board. Sailing along the coast, we soon lost sight of the barren lava-flows, and everything appeared thickly

wooded. The green zone on top was plainly visible, as the day was fine and clear. We passed by the cove where the tortoise-hunters went in, and saw good tortoise country along the hillsides. We anchored about three o'clock.

August 7, 1906.—Went up some distance into the interior, about to the beginning of the green zone—1200 feet.

August 9, 1906.—Sailed from James Bay for Cowley Mountain.

### **Testudo chathamensis** Van Denburgh

Chatham Island Tortoise

Plates 64 to 69.

*Testudo chathamensis* Van Denburgh, Proc. Cal. Acad. Sci. (4), I, 1907, p. 4; Siebenrock, Zool. Jahrb., Suppl. X, 3, 1909, p. 533.

*Type specimen.*—California Academy of Sciences No. 8127. Skeleton of adult male. Straight length 35.25 inches. Found in a cave on Chatham Island, by R. H. Beck and Joseph R. Slevin, Feb. 12-14, 1906.

*Distribution.*—Chatham Island.

*Material.*—The Academy has a skin with bones of an adult female, the bony carapaces of two adult males and a number of skulls and other bones. The Honorable Walter Rothschild writes me that he has a young male specimen. It is probable that this species is now almost or quite extinct.

*Diagnosis.*—No nuchal; gulars paired; fourth cervical vertebra biconvex; carapace depressed, front elevated in male; height at nuchal notch less than 41% of straight length (male 34 to 36 female 27%); male flat-backed, female dome-shaped, difference between percentages of heights at third vertebral and at nuchal notch 6 to 11 in male, 24 in female; carapace of male slightly saddle-shaped but broad, width at margin of junction of second and third marginals 53% in male; anterior marginals but little everted; length over curve in male 112 to 117%, female 126%; vertical distance from lower surface of plastron to lower edge of lateral marginals small, 4% to 6%; general size moderate, straight length in male 35.25 inches, female 22.5 inches; pectoral plates much reduced, not meeting on mid-line; eighth marginal plate not reduced; jaws and throat of female black.

TABLE OF MEASUREMENTS OF CHATHAM ISLAND TORTOISES.

| Number | Sex | Straight | | | Curved | | | Height | | | Height to marginals | | Plastron | | Fore Limb | | Hind Limb | | Axilla to Elbow | | Neck | | Tail | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Length | Width | Per Cent | Length | Per Cent | Width | Per Cent | Width 2d to 3d marginals | Per Cent | Middle | Per Cent | Front | Per Cent | | Per Cent | | Per Cent | | Per Cent | | Per Cent | | Per Cent |
| 8127 | ♂ | 35.25 | 24.25 | 69 | 39.5 | 112 | 38. | 108 | 18.5 | 53 | 14. | 40 | 12. | 34 | 1.5 | 4 | 26.25 | 75 | | | | | | |
| 8131 | ♂ | 27.6 | 21. | 76 | | | | | | | | | | | | | 20. | 79 | | | | | | |
| 8132 | ♂ | 25.25 | 18.75 | 74 | 29.5 | 117 | 30. | 118.8 | 13.4 | 53 | 11.75 | 47 | 9. | 36 | 1.5 | 6 | 18.25 | 81 | 10.4 | 46 | 10.2 | 45 | 4.8 | 21 | 11.6 | 52 | 3. | 13 |
| 8133 | ♀ | 22.5 | 17. | 75.6 | 28.25 | 125.6 | 26. | 115.6 | 10.3 | 46 | 11.5 | 51 | 6. | 27 | 1.4 | 6 | | | | | | | | | | | | |

*General remarks.*—The Chatham Island tortoise is one of the lowest, most depressed, of the Galapagoan races. It is most similar in shape to *Testudo güntheri* and *Testudo microphyes* of Albemarle Island. It differs from both in the frequent, or perhaps constant, reduction of the pectoral plates. The only living specimen found by our expedition was a small but very old female. It is much more dome-shaped than the males found in the cave. It had lost one of its fore limbs in early life, only the head of the humerus remaining, and the shell is not symmetrically developed, being smaller on this side.

*Field Notes.*—October 15-18, 1905.—Three days were spent in hunting near Wreck Bay, Chatham, but only geckos and *Tropiduri* were found.

Jan. 24, 1906.—Anchor was again cast in Wreck Bay.

Jan. 25, 1906.—Went ashore for the morning. Pouring rain most of the time. No one did much collecting except near the beach. Found only a few geckos and *Tropiduri.*

Jan. 26, 1906.—Weather dried up a little, and we went ashore again. Too wet to do much.

Jan. 27, 1906.—Went ashore collecting, and made for higher altitudes. Went up to about 800 feet, and found everything wet and muddy with no signs of any reptiles.

Jan. 29, 1906.—Went to the top of Chatham Island. Found the country different from anything seen so far. It is just like large pastures and fields of grass. The soil is damp everywhere, and no reptiles were seen. The country to the east is a large plateau, and seems to be wooded fairly well in some portions. There are many small lakes on the opposite side from our anchorage (the southwest side). The island is so easily accessible that it seems hardly probable that there could be a tortoise left on it. The next time we stop here, we probably shall be able to explore the other side for a couple of days at least, if the weather is good.

Feb. 7, 1906.—Sailed at day-break for Fresh Water Bay, Chatham Island, but on account of wind and currents failed to make it; so made an anchorage east of Stephens Bay.

Feb. 8, 1906.—Went ashore at our present anchorage, and worked up to about 1000 feet altitude. The country is all rough lava thickly grown over with trees and shrubs. The

higher portions look like good tortoise country, and are more open than below. No signs of tortoises were encountered, however, and no bones were found. Everything is very green, and the ground had been thoroughly soaked by recent rains. We expect to sail for Stephens Bay in the morning.

Feb. 10, 1906.—Went ashore at Sappho Cove and worked inland. The country is a plateau of recent lava, covered sparingly with cactus and fairly well with trees. Beck worked in the same general direction and had the great fortune to run on to a tortoise. It was eating cactus (*Opuntia*) when found. The right fore-leg was missing, and it seems hard to tell whether this was natural or the result of an accident. The ovaries contained eggs in yolk form. The locality where this tortoise was found was about four miles inland from Sappho Cove, and at about 300 feet elevation.

Feb. 12-14, 1906.—Went into the interior with Beck to search for tortoises. We worked for two days and a half around the central portion of the island without finding the least sign of a living tortoise. The entire country is rough lava overgrown with brush and trees. Cactus is fairly abundant. *Cereus* is the most common, while *Opuntia* is fairly common. Tortoises are likely to be found around the *Opuntia* if any are present, for the flat leaves often fall to the ground, and the spines are not so tough as those of the *Cereus*. We went to the top of a small hill and took the following bearings for the position of the living tortoise taken on February 10th: Mt. Pitt bore N. E. ½ N.; Finger Point bore N. W. by W. Kicker Rock bore W. by N.; top of island bore S. W. ½ S.; East Rock bore S. E. by E. The tortoise lay about three miles due west of this position. We had the good fortune to run across a large cave containing the remains of about seventeen tortoises. We made our headquarters in this cave, and looked over all the remains, collecting the best specimens. I made measurements in all possible cases of those we could not take.

1.—Collected a good set of bones, marked O. [C. A. S. No. 8128]. The carapace was far gone and not worth taking, inasmuch as we got good specimens. The plastron was intact. It was sunken like a male tortoise, and the indentation was very prominent with a ridge on the back part, as in the male

tortoises of Duncan Island. Length of plastron 610 mm.; width at front curves 300 mm.; greatest width of shell 570 mm.; length of indentation in plastron 340 mm.; width of indentation 320 mm. Some of the marginal plates were loosely attached to the carapace. Some old dried grass from the intestines could still be seen and several old plates of a brown color but nearly rotted away were near the remains.

2.—Bones marked X [C. A. S. No. 8129] from remains so badly rotted away that no measurements could be taken.

3.—Skull marked 8 [C. A. S. No. 8130]. No bones or shell could be found near by.

4.—Collected one shell with carapace and plastron in perfect condition [C. A. S. No. 8132], but no bones were found with it.

5.—Found one old shell which measured as follows: Length of plastron 440 mm.; width between front curves 230 mm.; greatest width of shell 410 mm. Several bones were near by, shoulder bones and pelvis, but very soft and crumbling away.

6, 7.—Saw two more skeletons all crumbled away so that no measurements could be taken.

8.—A shell in fairly good condition. Greatest width of shell 523 mm.; greatest length of shell 665 mm.; distance between front curves of plastron 270 mm.; distance between hind curves of plastron 310 mm.; width of plastral indentation 280 mm.; length of indentation 340 mm. This was probably a male, as the indentation in the plastron is very prominent with a ridge at the back as in the male Duncan tortoises. Skull marked with a star [C. A. S. No. 8131] belongs to this tortoise. The other bones were in bad condition.

9.—One old carapace showed the following measurements: length of carapace 670 mm.; width between front curves of plastron 320 mm.; between hind curves of plastron 400 mm.

10.—One old piece of plastron found. Width between front curves 205 mm.

11.—Bones and large shell collected [C. A. S. No. 8127], marked with a rectangle. Four marginal plates still on the front of the carapace.

12.—One old skeleton in which the front curves of the plastron measured 200 mm.

13.—One old skeleton. Greatest width of shell 405 mm.; width between front curves of plastron 215 mm.

14–15.—Two more skeletons all crumbling away.

It appears that the tortoises fell into this cave while in search of food or water. Once in, it was impossible for any to get out, and consequently they starved to death. Some of the shells lay with the plastron upward, while others were in a perfectly natural position. They were protected from moisture and probably had been in the cave many years.

Feb. 15, 1906.—Sailed for Fresh Water Bay.

Feb. 21, 1906.—Arrived at Wreck Bay this morning after an attempt to reach Fresh Water Bay.

Feb. 22, 1906.—Met the schooner from Guayaquil and saw the Captain, who is an Englishman. He says he has taken tortoises on Chatham Island, and that he ate the last one on the island some twenty years ago.

July 3–July 8, 1906, were also spent at Chatham, but nothing further was learned regarding tortoises.

## Testudo microphyes Günther

Tagus Cove Tortoise

Plates 70 to 83.

*Testudo microphyes* GÜNTHER, Trans. Royal Soc. Lond., CLXV, 1875, p. 275, pls. 36, 37 fig. B, 38 fig. B, 39 fig. B; GÜNTHER, P. Z. S., 1877, p. 66; GÜNTHER, Gigantic Land Tortoises Brit. Mus., 1878, p. 78, pls. XXXII-XXXVIII, XLII fig. B, XLIII fig. B, XLIV fig. B, XLV figs. A-C; BOULENGER, Cat. Chelonians Brit. Mus., 1889, p. 170; STRAUCH, Mém. Acad. Sci. St. Petersb. (7), XXXVIII, 2, 1890, p. 53; VAILLANT, Bull. Mus. d'Hist. Nat. Paris, 1900, p. 228, HELLER, Proc. Washington Acad. Sci., V, 1903, p. 56; BECK, Seventh Report N. Y. Zool. Soc., 1903, p. 13; SIEBENROCK, Zool. Jahrb., Suppl. X, 3, 1909, p. 534.

*Type specimen*—British Museum. Adult female. Straight length 22.5 inches. Origin unknown.

*Distribution.*—Günther and other authors have thought that *Testudo microphyes* was confined to the vicinity of Tagus Cove, Albemarle Island. The Academy's collection, however, contains specimens from Cape Rose, on the southern coast of Albemarle Island, which I am unable to distinguish from those secured at Tagus Cove.

*Material.*—The Academy has thirteen males and one young female from Tagus Cove, and four males and a female from Cape Rose. Many museums contain specimens of this tortoise, which is not rare in collections.

*Diagnosis.*—No nuchal; gulars paired; fourth cervical vertebra biconvex; front of carapace low, in males higher than in females; height at nuchal notch not more than 44% (34 to 43%) of straight length; difference between percentages of front and middle heights less than 14 (2 to 14); carapace not saddle-shaped, not narrow anteriorly, width at margin of junction of second and third marginals not less than 46% (46 to 57%); first marginals not enlarged, not everted, their ventral surfaces not vertical, their most prominent points separated by less than 25% (15 to 24%); length over curve not more than 123% (114 to 123%); width over curve less than length over curve or exceeding it by less than 5%; vertical distance from lower surface of plastron to lower edge of lateral marginals small, 3 to 7%; general size large, straight length 25 to 40.5 inches; plastron short, 65 to 80%; plates nearly smooth in adults; pectorals forming suture on median line; eighth marginal plate not reduced; lower jaw and throat of males not marked with yellow.

## TABLE OF MEASUREMENTS OF TAGUS COVE, ALBEMARLE ISLAND, TORTOISES.

| Number | Sex | Straight | | | Curved | | | | Width 2d to 3d marginals | Per Cent | Height | | | | Height to marginals | Per Cent | Plastron | Per Cent | Fore Limb | Per Cent | Hind Limb | Per Cent | Axilla to Elbow | Per Cent | Neck | Per Cent | Tail | Per Cent |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Length | Width | Per Cent | Length | Per Cent | Width | Per Cent | | | Middle | Per Cent | Front | Per Cent | | | | | | | | | | | | | | |
| 8158 | ♂ | 40.5 | 25.4 | 63 | 47.1 | 116 | 43.5 | 107 | 18.7 | 46 | 16.9 | 42 | 14.6 | 36 | 1.8 | 4 | 27.2 | 67 | 18.4 | 45 | 17.2 | 42 | 9.6 | 24 | 19.6 | 48 | 5. | 12 |
| 8157 | ♂ | 39.5 | 27.9 | 71 | 47.9 | 121 | 46. | 116 | 20.5 | 52 | 18.6 | 47 | 14. | 35 | 2.4 | 6 | 28.9 | 73 | | | | | | | | | | |
| 8162 | ♂ | 38.3 | 25. | 65 | 43.6 | 114 | 40.25 | 115 | 19. | 50 | 16.2 | 42 | 12.7 | 33 | 2.2 | 6 | 25. | 65 | | | | | | | | | | |
| 8167 | ♂ | 37.8 | 26.4 | 70 | 43.9 | 116 | 43. | 114 | 17.75 | 47 | 17.8 | 47 | 15. | 40 | 2.5 | 7 | 26.8 | 71 | 18.4 | 49 | 17.2 | 46 | 10. | 26 | 20.8 | 55 | 3.8 | 10 |
| 8168 | ♂ | 37.5 | 27.5 | 73 | 44. | 117 | 42.5 | 113 | 20. | 53 | 17.3 | 46 | 14.4 | 38 | 2.5 | 7 | 26.5 | 71 | 16.8 | 45 | 14.8 | 39 | 10. | 27 | 20.4 | 54 | 4. | 11 |
| 8160 | ♂ | 37.3 | 27. | 72 | 45. | 121 | 44.75 | 120 | 20. | 54 | 18.25 | 49 | 15. | 40 | 2.25 | 6 | 28.8 | 77 | | | | | | | | | | |
| 8159 | ♂ | 37.3 | 26.8 | 72 | 45.4 | 122 | 45.6 | 123 | 19.3 | 52 | 18.1 | 49 | 14.2 | 38 | 2.2 | 6 | 26.2 | 70 | 18.6 | 50 | 17.2 | 46 | 10.4 | 28 | 19.6 | 53 | 4.6 | 12 |
| 8163 | ♂ | 37. | 27.8 | 75 | 43. | 116 | 42. | 114 | 18.5 | 50 | 15.9 | 43 | 14.4 | 39 | 2. | 5 | 27.4 | 74 | | | | | | | | | | |
| 8164 | ♂ | 36.25 | 26.4 | 73 | 43.1 | 116 | 40.8 | 110 | 18.5 | 51 | 16.6 | 46 | 13.3 | 37 | 2.5 | 7 | 25.75 | 71 | 13.2 | 36 | 9.6 | 26 | 9.2 | 25 | 18. | 50 | 3.8 | 10 |
| 8165 | ♂ | 36. | 27.1 | 75 | 42.5 | 118 | 43.8 | 122 | 20.2 | 56 | 16.3 | 45 | 13.4 | 37 | 1.1 | 3 | 26.2 | 73 | 17.2 | 48 | 16. | 44 | 10.4 | 29 | 20.4 | 57 | 5.6 | 16 |
| 8166 | ♂ | 36. | 26.5 | 74 | 43. | 119 | 43. | 119 | 18.2 | 50 | 17. | 47 | 14.1 | 39 | 2.6 | 6 | 25.6 | 71 | | | | | | | | | | |
| 8161 | ♂ | 34.5 | 24.5 | 71 | 40.2 | 116 | 41.2 | 119 | 18.8 | 53 | 16.1 | 47 | 13. | 38 | 1.7 | 5 | 24. | 70 | | | | | | | | | | |
| 8156 | ♂ ? | 14.75 | 11.6 | 84 | 18.5 | 126 | 17.75 | 120 | | | 7.25 | 49 | 4.25 | 29 | 1. | 7 | 12.75 | 86 | 6.4 | 43 | 6. | 41 | | | 7.2 | 49 | 1.36 | 9 |
| 8155 | ♀ | 13.25 | 11. | 83 | 17.5 | 131 | 17.25 | 130 | | | 7.25 | 55 | 4. | 30 | | | 12. | 91 | | | | | | | | | | |

## TABLE OF MEASUREMENTS OF CAPE ROSE TORTOISES.

| Number | Sex | Straight | | | Curved | | | Height | | | Width 2d to 3d marginals | | Height to marginals | | Plastron | | Fore Limb | | Hind Limb | | Axilla to Elbow | | Neck | | Tail | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Length | Width | Per Cent | Length | Per Cent | Width | Middle | Per Cent | Front | Per Cent | Per Cent | | Per Cent | | Per Cent | | Per Cent | | Per Cent | | Per Cent | | Per Cent | |
| 8169 | ♂ | 38. | 26.3 | 70 | 46.8 | 122 | 45. | 17.8 | 47 | 15.5 | 41 | 21.6 | 57 | 2.5 | 7 | 27.6 | 73 | 16.8 | 44 | 16.4 | 43 | | | 17.2 | 45 | 4. | 11 |
| 8170 | ♂ | 35.25 | 25. | 71 | 42. | 119 | 41. | 16.75 | 48 | 14. | 40 | 20. | 57 | 2. | 6 | 27. | 77 | 16.8 | 48 | 14.6 | 41 | 8. | 23 | 16. | 46 | 4.2 | 12 |
| 8171 | ♂ | 35. | 24.2 | 69 | 40. | 114 | 38.6 | 15.1 | 43 | 12.2 | 35 | 18.9 | 54 | 2.6 | 7 | 23.7 | 68 | 17.8 | 51 | 14.8 | 42 | 8. | 23 | 15.8 | 45 | 3.2 | 9 |
| 8172 | ♂ | 29.2 | 22. | 75 | 33.8 | 116 | 34.1 | 13. | 45 | 12.5 | 43 | 16.4 | 56 | 2.1 | 7 | 21.8 | 75 | 14.6 | 50 | 12. | 41 | 7.6 | 26 | 13.6 | 47 | 3.4 | 12 |
| 8173 | ♀ | 25. | 18.8 | 75 | 30.8 | 123 | 31.8 | 12.8 | 51 | 9.2 | 37 | 13.4 | 54 | 1.8 | 7 | 20. | 80 | 13.2 | 53 | 11.8 | 47 | 5.6 | 22 | 13.2 | 53 | 1.8 | 7 |

*General remarks.*—The tortoises of Tagus Cove Mountain and vicinity are very different from those of the northern end of Albemarle Island. The males have low shells with flat backs, the front of the carapace being but little below the level of the middle of the back. The shell is thin and light. These tortoises bear most resemblance to those of Chatham Island and the *T. güntheri* of southeastern Albemarle. The males from Cape Rose seem to be absolutely identical with those from Tagus Cove.

*Field Notes.*—March 23, 1906.—Anchored at Tagus Cove. Beck and King went ashore to hunt for tortoises. Beck found two. One of these he skinned and brought on board this evening. It is a male.

March 24, 1906.—Went in with King to get the tortoise found yesterday. The country in the vicinity of the cove is somewhat barren, and, on the hillsides and in the valleys, several fresh lava-flows can be seen that have no vegetation at all. The place where we saw the signs of tortoises is a valley about a mile from the shore. Most of it was grown over with brush, but thick only in places. We saw several old skeletons with the bones crumbled to dust. There were no fresh signs of tortoises, other than the two found. The one we got today was at the farther end of the valley, right on the edge of a barren lava-flow. While King and I got this one out, Mr. Beck went hunting for more tortoises, and found a large male at the foot of the mountain and directly opposite the cove. I suppose we shall go in for him tomorrow.

March 25–31, 1906.—Worked on tortoises up on the mountain all the week. We found no fresh trails in the valley, so went up the mountain, which presents a similar appearance as regards growth of trees, etc. There are two large lava-flows extending down the mountain sides, with green patches on them, and some of these were well cut up with tortoise trails. The tortoises work all through the brush on the mountain side, and it cannot be said that they are rare; but it is so much work to get them, that people report them scarce. The females, however, appear to be rare, as none have been found by us so far. They are smaller than the males and have more fat, so that they probably have been killed by oil-hunters when they came down into the valley. All the tortoises we

have taken were heading up the mountain. At Tagus and Iguana coves I noticed that the tortoises were covered with ticks all over the skin and along the cracks between the plates of the plastron. Cactus is somewhat scarce here compared with other places, and the chief part of the tortoises' diet is a coarse grass that is abundant on the hills and in the valleys. The tortoises here seem to be of a uniform size and have thin shells.

April 2, 1906.—During the morning I worked on board with tortoises, etc. Mr. Beck went over to Narborough to hunt for tortoises. King and I went up to camp this afternoon, to carry out a tortoise we had tied up on the mountain.

April 3, 1906.—Skinned the tortoise and carried him out—a good day's work.

April 4, 1906.—King and I went to the foot of the mountain to get a tortoise Beck said he had tied up, but after hunting all day failed to find it. We obtained a good view of the north side of the mountain, which appears to be all fresh lava with very few patches of vegetation. The whole country to the north is fresh lava. Cape Berkeley was plainly visible, and appeared very high and steep. The mountain at Banks Bay was also seen, but the character of the country and vegetation could not be made out.

April 7, 1906.—Went ashore to get the tortoise Beck tied up several days ago. We found him a long way up the mountain and not where Beck told us to look. His stomach contained grass.

March 14, 1906.—We sailed down the coast toward the high mountain at Iguana Cove, and anchored at evening about six or eight miles east of it.

March 15, 1906.—Went ashore, about two miles west from our anchorage, at a small cove on the coast in the vicinity of Cape Rose. We got into a fine tortoise country, where the natives had been killing off the tortoises some years ago. There was a small plateau, well cut up with cattle trails and having abundant cactus (*Opuntia*). There was also an abundance of the trees which produce a fruit that looks like a small apple. This fruit appears to have a somewhat poisonous effect, and goes through the tortoise like a purge. The tortoises taken here were full of this fruit, and the intestines were much

swollen and very thin, so that they looked almost membranous. The fruit passes through the intestine unchanged except in color, which fades from green to a light yellow. The tortoises seem to prefer this food to cactus, for there was an abundance of the latter all around. The tortoises taken at this particular place seem to be much fatter than any taken thus far, and their shells are very light for their size.

July 27, 1906.—Stewart says the plant with the apple-like fruit is *Hippomane mancinella.*

## Testudo güntheri Baur

Vilamil Mountain Tortoise

Plates 84 to 92.

*Testudo elephantopus* GÜNTHER, [*nec* Harlan] Trans. Royal Soc., CLXV, 1875, p. 261, pls. 33, 37 fig. A, 38 fig. A, 39 fig. A, 40 fig. A, 41 fig. B, 42 fig. A, 43, 44 figs. A,A', C,D; GÜNTHER, Gigantic Land Tortoises Brit. Mus., 1877, p. 63, pls. XXX fig. A, XLII fig. A—XLIV fig. A, XLVI fig. A, LI—LIII; ROTHSCHILD, Novit. Zool., IX, 1902, p. 448; ROTHSCHILD, Novit. Zool., IX, 1902, p. 618; HELLER, Proc. Washington Acad. Sci., V, 1903, p. 53; SIEBENROCK, Zool. Jahrb., Suppl. X, 3, 1909, p. 532.

*Testudo nigra* BOULENGER, Cat. Chelonians Brit. Mus., 1889, p. 170.

*Testudo güntheri* BAUR, Am. Nat., XXIII, Dec. 1889 (1890), p. 1044.

*Type specimen.*—Oxford Museum, England. Skeleton of adult male. Straight length 31 inches. Purchased of a dealer in Paris. Origin unknown.

*Distribution.*—Vilamil Mountain and vicinity in the southeastern part of Albemarle Island.

*Material.*—There are in the Academy's collection forty-one specimens which I refer to this race. The Tring museum has a number of specimens.

*Diagnosis.*—No nuchal; gulars paired; fourth cervical vertebra biconvex; front of carapace from 5 to 22% lower than middle; height at nuchal notch not more than 44% (29 to 44%) of straight length; difference between percentages of heights at third vertebral and at nuchal notch more than 5 (5 to 22); carapace not saddle-shaped, broad anteriorly, width at margin of junction of second and third marginals not less than 46% (46 to 61%); first marginals not everted, without prominent points; length over curve not more than 128% (114 to 128%), never greater than width over curve; vertical distance from lower surface of plastron to lower edge of lateral marginals small, 3 to 9%; general size usually rather small, straight length 23.7 to 40 inches; plastron of moderate length, 70 to 87%, often with posterior knobs even in females; plates generally smooth in adults; pectorals forming a suture on median line; eighth marginal plate not reduced, with a considerable superior border; lower jaw and throat in males sometimes marked with yellow.

## TABLE OF MEASUREMENTS OF VILAMIL MOUNTAIN TORTOISES.

| Number | Sex | Straight | | | Curved | | | | Width 2d to 3d marginals | Per Cent | Height | | | | Height to marginals | Per Cent | Plastron | Per Cent | Fore Limb | Per Cent | Hind Limb | Per Cent | Axilla to Elbow | Per Cent | Neck | Per Cent | Tail | Per Cent |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Length | Width | Per Cent | Length | Per Cent | Width | Per Cent | | | Middle | Per Cent | Front | Per Cent | | | | | | | | | | | | | | |
| 8391 | ♂ | 40. | 30.6 | 77 | 46.3 | 116 | 49. | 123 | 23. | 58 | 18.25 | 46 | 16.3 | 41 | 2.2 | 6 | 28.6 | 70 | | | | | | | | | | |
| 8194 | ♂ | 39. | 32.5 | 83 | 46.6 | 120 | 49.4 | 127 | 23.7 | 61 | 17.9 | 46 | 14. | 36 | 1.1 | 3 | 30.75 | 79 | 17.6 | 45 | 16. | 41 | 9.6 | 25 | 20. | 51 | 4. | 10 |
| 8220 | ♂ | 28. | 20.5 | 73 | 32.75 | 117 | 35.5 | 127 | 14.5 | 52 | 13.6 | 49 | 9.75 | 35 | 1.65 | 6 | 20. | 71 | | | | | | | | | | |
| 8256 | ♂ | 25.1 | 19.65 | 78 | 30.3 | 121 | 32.1 | 128 | 14.3 | 57 | 12.5 | 50 | 8.6 | 34 | 1.5 | 6 | 20. | 80 | | | | | | | | | | |
| 8217 | ♂ | 24.5 | 19.75 | 81 | 29. | 118 | 31. | 126 | 13. | 53 | 12. | 49 | 8.5 | 31 | 1.5 | 6 | 19.25 | 79 | | | | | | | | | | |
| 8199 | ♀ | 28.8 | 22.5 | 78 | 34.1 | 122 | 35.7 | 127 | 14.7 | 51 | 12.7 | 44 | 9.6 | 33 | 1. | 3 | 21.8 | 76 | | | | | | | | | | |
| 8189 | ♀ | 28.5 | 22.75 | 79 | 33.25 | 116 | 37. | 129 | 15.8 | 55 | 14.5 | 51 | 11. | 39 | 1.8 | 6 | 22.5 | 79 | 12. | 42 | 10.4 | 36 | 5.2 | 18 | 14. | 49 | 1.8 | 6 |
| 8232 | ♀ | 28.2 | 20.9 | 74 | 33. | 117 | 34.6 | 123 | 15.2 | 54 | 13.2 | 47 | 9.5 | 34 | 1.8 | 6 | 19.6 | 70 | | | | | | | | | | |
| 8239 | ♀ | 27.9 | 21.6 | 77 | 33.25 | 119 | 34.5 | 124 | 13.3 | 48 | 13.3 | 48 | 8.7 | 31 | 1.3 | 4 | 21.5 | 77 | | | | | | | | | | |
| 8234 | ♀ | 27.9 | 21.2 | 76 | 33.1 | 119 | 34.9 | 125 | 13.3 | 48 | 13. | 47 | 9. | 32 | 1.25 | 4 | 21.2 | 76 | | | | | | | | | | |
| 8251 | ♀ | 27.3 | 22.3 | 82 | 31.6 | 116 | 34.7 | 127 | 14.8 | 54 | 13.3 | 49 | 10.7 | 39 | 1.75 | 6 | 21.4 | 78 | | | | | | | | | | |
| 8237 | ♀ | 26.75 | 20.75 | 77 | 32.25 | 121 | 33.5 | 125 | 14.75 | 51 | 12.75 | 48 | 9.25 | 35 | 1. | 4 | 21. | 79 | | | | | | | | | | |
| 8225 | ♀ | 26.3 | 19.9 | 76 | 31.9 | 121 | 32.6 | 124 | 13.6 | 52 | 12. | 46 | 8. | 30 | 1.4 | 5 | 20. | 76 | | | | | | | | | | |
| 8269 | ♀ | 26. | 22. | 85 | 32. | 123 | 34.3 | 132 | 13.8 | 53 | 13.1 | 50 | 9.5 | 37 | 1.6 | 6 | 20.5 | 75 | | | | | | | | | | |
| 8209 | ♀ | 26. | 21. | 81 | 30.2 | 116 | 32.5 | 125 | 13.4 | 52 | 12.6 | 48 | 10. | 38 | 1.9 | 7 | 20.6 | 75 | 12.4 | 48 | 11.2 | 43 | | | 12.8 | 49 | 1.5 | 6 |
| 8224 | ♀ | 26. | 20.3 | 78 | 30.9 | 119 | 33.6 | 129 | 13.6 | 52 | 13. | 50 | 10. | 38 | 1.5 | 6 | 21.5 | 83 | | | | | | | | | | |
| 8244 | ♀ | 26. | 20. | 77 | 30. | 115 | 32.9 | 127 | 13.2 | 51 | 12.5 | 48 | 9.1 | 35 | 1.5 | 6 | 19.4 | 75 | | | | | | | | | | |
| 8210 | ♀ | 25.9 | 19.75 | 76 | 30.8 | 119 | 32.8 | 127 | 13.4 | 52 | 12.6 | 49 | 9.5 | 37 | 1.4 | 5 | 19.25 | 74 | 11.6 | 45 | 10.6 | 41 | 6. | 23 | 13.6 | 52 | 2. | 8 |
| 8215 | ♀ | 25.75 | 19.5 | 76 | 30.75 | 119 | 31.75 | 123 | 12.7 | 49 | 13. | 50 | 8.9 | 35 | 2.1 | 8 | 19.5 | 76 | | | | | | | | | | |
| 8190 | ♀ | 25.7 | 20.7 | 81 | 31.2 | 121 | 33.2 | 129 | 14. | 54 | 13.25 | 52 | 9.9 | 39 | 1.9 | 7 | 20.5 | 80 | 11.2 | 44 | | | 5.1 | 20 | 12.4 | 48 | 2.2 | 9 |
| 8268 | ♀ | 25.5 | 22. | 86 | 32.5 | 124 | 34.7 | 136 | 15. | 59 | 13.2 | 52 | 10.1 | 40 | 1.5 | 6 | 21.5 | 84 | | | | | | | | | | |
| 8265 | ♀ | 25.5 | 21.7 | 85 | 31.4 | 123 | 33.5 | 131 | 15.5 | 61 | 12.4 | 49 | 10.6 | 42 | 2. | 8 | 21. | 82 | | | | | | | | | | |
| 8206 | ♀ | 25.5 | 20. | 78 | 30.8 | 117 | 33.2 | 130 | 13.2 | 52 | 13.2 | 52 | 10. | 39 | 1.75 | 7 | 20.1 | 75 | 11.6 | 45 | 10.8 | 49 | 6. | 24 | 12.4 | 49 | 1.2 | 5 |
| 8212 | ♀ | 25.5 | 19.5 | 76 | 29.5 | 116 | 31. | 122 | 13.3 | 52 | 11.5 | 45 | 9.25 | 36 | 1.4 | 5 | 19.5 | 76 | | | | | | | | | | |
| 8226 | ♀ | 25.4 | 21. | 83 | 30.1 | 119 | 34.25 | 135 | 14.2 | 56 | 13. | 51 | 10. | 39 | 1.5 | 6 | 21. | 82 | | | | | | | | | | |
| 8240 | ♀ | 25.4 | 19. | 75 | 30. | 118 | 31.5 | 124 | 13.5 | 53 | 13.5 | 53 | 9.3 | 37 | 1.75 | 7 | 19.3 | 76 | | | | | | | | | | |
| 8191 | ♀ | 25.1 | 19.4 | 77 | 29.9 | 119 | 31.6 | 126 | 12.6 | 50 | 12. | 48 | 8.6 | 34 | 1.6 | 6 | 19.3 | 77 | | | | | | | | | | |
| 8233 | ♀ | 25. | 20. | 80 | 30. | 120 | 34.2 | 137 | 12.8 | 51 | 12.5 | 50 | 11. | 44 | 1.4 | 6 | 21. | 84 | | | | | | | | | | |
| 8263 | ♀ | 25. | 19.6 | 78 | 29.7 | 119 | 30.4 | 122 | 11.4 | 46 | 12.3 | 49 | 9.1 | 36 | 1.6 | 6 | 19.5 | 75 | | | | | | | | | | |
| 8259 | ♀ | 24.8 | 21.1 | 85 | 29.1 | 117 | 30.5 | 122 | 12.8 | 51 | 11.3 | 46 | 7.25 | 29 | 1.2 | 5 | 19.1 | 77 | | | | | | | | | | |
| 8218 | ♀ | 24.7 | 20.6 | 83 | 29.25 | 118 | 32. | 130 | 13.2 | 53 | 11.9 | 48 | 8.8 | 32 | 1.6 | 6 | 19.5 | 79 | | | | | | | | | | |
| | ♀ | 24.7 | 19.6 | 79 | 29.5 | 117 | 32.2 | 130 | 12.1 | 49 | 12. | 49 | 8.5 | 34 | 1.5 | 6 | 20.25 | 82 | 13.5 | 55 | 12. | 49 | 6. | 24 | 10.5 | 43 | | |
| 8267 | ♀ | 24.7 | 19.4 | 79 | 29.25 | 118 | 31. | 126 | 13. | 52 | 11.6 | 47 | 8.75 | 35 | 1.2 | 5 | 19.25 | 78 | | | | | | | | | | |
| 8230 | ♀ | 24.6 | 19.6 | 80 | 29.7 | 121 | 33. | 134 | 13.1 | 53 | 12.5 | 51 | 9. | 37 | 1.4 | 6 | 19.6 | 80 | | | | | | | | | | |
| 8248 | ♀ | 24. | 20.7 | 86 | 29.6 | 123 | 32.4 | 135 | 12.3 | 51 | 12.3 | 51 | 8.8 | 37 | 1.7 | 7 | 19.5 | 81 | | | | | | | | | | |

TABLE OF MEASUREMENTS OF SOUTH ALBEMARLE TORTOISES.

| Number | Sex | Straight | | Curved | | | | Height | | | | | | Plastron | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Length | Width | Length | Per Cent | Width | Per Cent | Width at 1/4 to 3/4 marginals | Per Cent | Middle | Per Cent | Front | Per Cent | Height to marginals | Per Cent | | Per Cent |
| 8197 | ♀ | 27.8 | 21.25 | 33.4 | 76 | 36.3 | 131 | 13.6 | 49 | 14.3 | 51 | 10. | 36 | 1.6 | 6 | 21.25 | 76 |
| 8250 | ♀ | 27.2 | 21.6 | 33.4 | 80 | 35.7 | 131 | 14.6 | 54 | 13.9 | 51 | 9.1 | 33 | 1.4 | 5 | 20.25 | 74 |
| 8214 | ♀ | 26.4 | 23.3 | 32.6 | 88 | 37.6 | 142 | 13.5 | 51 | 14.4 | 55 | 10.1 | 38 | 1.5 | 6 | 21.3 | 87 |
| 8247 | ♀ | 25.8 | 20.4 | 30.1 | 79 | 34.4 | 133 | 13.1 | 51 | 13.75 | 53 | 10.6 | 41 | 1.7 | 7 | 20.7 | 80 |
| 8241 | ♀ | 25.4 | 20.25 | 32.5 | 80 | 32.6 | 128 | 12.3 | 48 | 13.6 | 54 | 8.1 | 32 | 2.3 | 9 | 21.1 | 83 |
| 8271 | ♀ | 23.7 | 16.5 | 27. | 70 | 27.5 | 116 | | | 11.9 | 50 | 6.9 | 29 | 1.75 | 7 | 17.5 | 74 |

*General remarks.*—The tortoises of southern Albemarle present many difficulties. The specimens from Iguana Cove seem to be quite uniform in shape, and it is probable that only *Testudo vicina* occurs there. Somewhat farther east, at Cape Rose, are found tortoises which I am unable to distinguish from those taken at Tagus Cove, which again appear to be constantly of one type. But when one collects still farther east, on Vilamil Mountain or in the vicinity of Turtle Cove or the old Cobos settlement, tortoises of two distinct types are found together. Those of one type agree closely with the tortoises of Iguana Cove, and I therefore include them under the head of *Testudo vicina.* Those of the other type are much more depressed, with less elevated backs, with the height to marginals very low, and have very smooth shells. These I refer to another race, for which the name *Testudo güntheri* seems available. They resemble both the Tagus Cove and the Chatham Island tortoises in many respects. A few specimens, included in the second table of measurements, are nearly intermediate in shape between the typical *T. güntheri* and the dome-shaped females of *T. vicina.* Altogether, the problem is a difficult one, and I am in some doubt whether these tortoises which I have called *T. güntheri* are really a distinct race or merely old individuals of the same race as those I have referred to *T. vicina.* I cannot understand, however, how age could produce changes in shape such as exist, and I therefore think it probable that the two great mountains of southern Albemarle—at Iguana Cove and Vilamil—each developed its own peculiar race of tortoise, perhaps at a time when these mountains were separate islands. If this view be correct, *T. vicina* has spread eastward more rapidly than *T. güntheri* has wandered toward the west. The following field notes are based upon tortoises of both kinds.

Ten eggs (No. 8426) taken Sept. 1, 1906, from tortoise No. 8197, measure 2.38x2.30, 2.37x2.36, 2.37x2.30, 2.37x2.24, 2.34x2.25, 2.33x2.28, 2.33x2.25, 2.30x2.30, 2.27x2.25 and 2.21x2.25 inches. The smallest eggs in our collection measure 2.10x1.87 and 2.01x1.90 inches. They are No. 8430 and were taken from tortoise No. 8197.

*Field Notes.*—Oct. 30, 1905.—We sailed for Turtle Cove, on leaving Brattle, and anchored early in the afternoon.

Nov. 1, 1905.—Went ashore at Turtle Cove and worked up the trail toward the settlement. Expect to go tomorrow along the coast in the direction of Iguana Cove, to look for some tortoises that the natives say are near the shore.

Nov. 2, 1905.—Went down the coast west of Vilamil about six miles to look for tortoises where Beck found them before. The country is level and cut up with cattle trails. We found five tortoises during the day. They all were taken near the cattle trails, in small patches they had dug up under the bushes. As they were found fairly near the beach, we brought four aboard alive, only skinning one that was farthest inland. These were the only tortoises seen by the party, but we could not well have taken more in the boat. We did not cover a great amount of country, and the tortoises may be fairly common in this locality.

Nov. 3, 1905.—I stayed on board all day skinning tortoises and iguanas. Mr. Beck bought another small tortoise from the natives today. We expect to sail for Indefatigable tomorrow to look for more tortoises in a different locality.

March 5, 1906.—I went up the trail toward the settlement (at Vilamil) but saw no reptiles except lizards. The country is a large plain of lava covered sparingly with cactus and brush.

March 6, 1906.—Went down the coast north of the port and found nothing. The country is a desert of lava. It was a day wasted as far as enlarging the collection was concerned, but I at least found out what the country is like.

March 7, 1906.—Went up the trail toward the settlement and collected more lizards, but saw no other reptiles. The weather is very hot now and has been so for several days past. Hunter and Gifford went up to the settlement collecting. They report seeing hundreds of bones of tortoises along the trail and at several water-holes where the tortoises used to gather. No live tortoises were seen below the settlement, and the natives say all have been killed off there, and that they no longer are abundant on the mountain.

March 8–9, 1906.—Worked on board ship.

March 10, 1906.—I worked on board in the morning, and in the afternoon we sailed about ten miles down the coast toward Iguana Cove, and anchored at eight o'clock.

March 11, 1906.—Mr. Beck went ashore and found two tortoises.

March 12, 1906.—Went ashore about a mile west of our anchorage to hunt for tortoises and to get the two Mr. Beck found yesterday. This portion of the coast is a large plateau which rises very gradually to the mountain at Iguana Cove and to lower hills in the distance to the eastward. This plateau is densely wooded with large trees and cactus and thick brush which, fortunately, is well cut through with cattle trails. The tortoises are rather common; at least, large ones are, while the smaller ones seem to have been all killed by the natives, if one may judge from the numerous skeletons scattered through the woods. We saw, during our two days ashore here, about ten tortosies, all males I think. They like the shade, and in the heat of the day prefer to stay in some hollow or under a bush. Judging from the amount of black mud on them, they wallow in the mud like swine. We found one tortoise lying in a mud hole with all legs stretched out and his head stuck in the mud. We also found one under a bush near a cattle trail, and so skinned him and brought him part way out. The day was very hot, and we could not make very good time. We ran out of water, and felt anything but active. Finally we left the tortoise on the beach down the coast and made for our boat, breaking through brush and mangroves every inch of the way. We reached the vessel after dark thoroughly tired out. We expect to go ashore in the morning, when the tide is low, and bring the tortoise around by the beach. King is pretty well under the weather, having drunk too much water from a hole we encountered near the end of our journey. The day was altogether too hot for us to carry tortoises.

March 13, 1906.—Beck and I went ashore and carried the tortoise down the coast to our boat. The tide was very low, so we carried it around by the beach. We went inland again from the boat to get another tortoise, and found one late in the afternoon. We partly skinned this one, cutting out all the heavy meat, and rushed him out to the coast, getting there just before dark. In this vicinity, near the old Cobos settlement, we noticed on some of the cattle trails the excrement from the tortoises. They had eaten the fruit of a large tree, which is abundant everywhere, and this fruit passed through the intestines unchanged without having been chewed or dis-

figured in any way. This fruit is shaped like an apple, and about an inch in diameter.

April 25–27, 1906.—We drifted up the coast toward Vilamil and, in the evening of the 24th anchored off the old Cobos settlement which we call Bull Beef Anchorage. Beck says we put in just to get some beef to salt. As King and I were the only ones working on tortoises here, we could not get more than one a day. We found them common near the coast, in mudholes under the shade of trees. The ones we found were buried in the soft black mud, with just their heads and the tops of their carapaces exposed. It would seem that the natives have killed off all the females, as we find only males. The two tortoises we took had stomachs nearly empty, and evidently had been in the mud for some time, since no traces could be seen where they went in. There are mudholes and lagoons all along the coast here, and cactus and grass are abundant, so that it is ideal tortoise-country.

August 16-19, 1906.—Sailed from Duncan, early on the morning of the 16th, for Vilamil, where we arrived on the evening of the 19th, after four days spent in beating against the wind and strong currents.

August 20, 1906.—Sailed into Turtle Cove, to our anchorage. We had to anchor outside last night as we arrived about dark, too late to get in. We are making preparations to go up the mountain to skin tortoises. A few tortoises have been brought in by the natives from along the coast toward Cape Rose, but they find it too much of a job to get many, having to cut a trail for each tortoise brought out. We expect to stay here until September 5. I have things ready now to pack away. All the tortoise skins are ready to stow away for the voyage home.

August 21, 1906.—Everything was ready to go up after the large tortoises on the top of the mountain, but we could not get the mules, so will wait another day.

August 22 to 30, 1906.—We went up with our outfit to the hacienda to start up the mountain. At this elevation (1300 feet) the weather is constantly rainy and foggy, and the prospects of camping are not very pleasant. There is nothing visible, in the way of reptiles. The grassy area commences at 1500 feet and extends clear to the rim of the crater, which is at an elevation of 3150 feet. We encountered our first

living tortoises about two miles from the top of the crater. In this place it almost seems as though one were seeing them in a park, for they are met simply lying around on the grass—some feeding and others sleeping. They follow the trails made by the cattle and pack mules, and we often had to turn off the trail to pass by them. They are by no means rare around this mountain, although great inroads have been made upon them by the oil-hunters. Those we saw on the way up the mountain were moderate-sized females. The males, being the larger, were killed off first for their oil, and consequently are rare.

We reached the top about noon and set our course toward a large valley to the southwest of the mountain, where the natives killed the large tortoises for their oil. We continued to travel through fine pasture land free from fog and dampness, for on the top of the mountain the weather is perfect. On all sides of us were tortoise skeletons—hundreds of them! With few exceptions, they all had been killed by the natives. The wild dogs have a few to their credit. These may be distinguished by the carapace and plastron being intact. The natives cut theirs open with axes. We saw no living tortoises on this steep slope of the crater, nor did we encounter any until we reached the level valley below. Fog hung over this valley early in the morning, and lifted a little toward noon. The vegetation here was the same as on the mountain—fine green grass and small trees. We made our camp in an old house the oil-hunters had left, and started on our search for tortoises. We soon found two near the house, but they were only moderate-sized ones. One of these we killed in order to get the liver for lunch, and, while we were eating, our native guide slipped out and cut off one of its legs for his own lunch. This spoilt it for a skin, so we saved only the skull. We skinned the other one in the afternoon. On our return to camp we found that the dogs had eaten what was left of our first tortoise. They ate even the shell, which, by morning, was half gone.

Next morning we started with two mules and our guide to follow the trail where the big tortoises used to be abundant, but found that they had been slaughtered by wholesale, so that we found no large ones. We saw only the ordinary females, which were common. We skinned four of them.

The following day King and I skinned three, that we found near the camp. Beck and the guide went out hunting again, but failed to find any large tortoises. The largest skeleton we saw measured seven spans. We collected a sack-full of old skulls in fairly good condition. Seeing that we could not get what was desired, Beck decided to return, and we started back Sunday with eight tortoises we had skinned on the trip. On the way up the mountain, and about half way to the hacienda, King found a large male tortoise that measured six spans. We decided to return next day and skin him. This we accomplished, and got back to the hacienda by dark with our ninth tortoise. This tortoise was a very old male. The plates on the side of the carapace were loose in life, and the plates on top all chipped up. The fore legs were scarred up where they had been chewed by dogs. Altogether, he was a regular old patriarch. The principal food of these tortoises was the grass that covers the entire country for miles around. One of the females contained eggs nearly ready to lay. The others had ovaries somewhat less developed, several containing large yolks. One female (C. A. S. No. 8189) had a scar in the right hind end of the carapace where a hole had healed over. Our guide explained that the natives made these holes to see whether the tortoises were fat enough to kill. Although this wound had grown over, it left a large abscess in the tortoise, the odor from which in skinning was anything but pleasant.

August 31, 1906.—Skinned tortoises collected by the natives and brought to the house at Vilamil. I am not sure of the exact locality where these tortoises were secured. I saw some brought down off the mountain, and most of them came from there, but probably a dozen or so came from the coast.

## Testudo vicina Günther

Iguana Cove Tortoise

Plates 93 to 110.

*Testudo vicina* Günther, Trans. Royal Soc. Lond., CLXV, 1875, p. 277, pls. 35 fig. A, 40 fig. B, 41 figs. A, C, 45 figs. C-D; Günther, Gigantic Land Tortoises Brit. Mus., 1877, p. 73, pls. XXXI, XLVII, fig. A, LIV, figs. C-D; Boulenger, Cat. Chelonians Brit. Mus., 1889, p. 170; Rothschild, Novit. Zool., IX, 1902, p. 448; Heller, Proc. Washington Acad. Sci., V, 1903, p. 54; Beck, Seventh Report N. Y. Zool. Soc. 1903, p. 7; Siebenrock, Zool. Jahrb., Suppl. X, 3, 1909, p. 534.

*Testudo elephantopus*, Baur, Am. Nat., XXIII, 1889, p. 1044; Lucas, Smith. Report, 1889 (1891), pp. 643-647, pl. CIV, figs. ——; Gadow, Cambridge Nat. Hist., VIII, 1901, p. 378.

*Testudo nigrita*, Cope, Proc. U. S. Nat. Mus. 1889, p. 147; Lucas, Smith. Report, 1889 (1891), pp. 643-647, pl. CIV, fig. ——.

*Type specimen.*—British Museum. Carapace of adult male. Straight length 33 inches. Origin unknown.

*Distribution.*—This tortoise probably is distributed throughout the whole southern end of Albemarle Island. At Iguana Cove it appears to be the only kind, but near Vilamil one finds both *Testudo vicina* and *Testudo güntheri.*

*Material.*—This is one of the commoner species in collections. The Academy has six from Iguana Cove, ten from the vicinity of the old Cobos settlement in southeastern Albemarle, and forty-five from near Turtle Cove and Vilamil Mountain.

*Diagnosis.*—No nuchal; gulars paired; fourth cervical vertebra biconvex; front of carapace moderately high in males, much lower than middle in females; height at nuchal notch less than 45% (31 to 44%) of straight length; difference between percentages of heights at third vertebral and at nuchal notch more than 9 (10 to 23); carapace not saddle-shaped, not narrow anteriorly, width at margin of junction of second and third marginals not less than 44% (44 to 59%); first marginals not greatly enlarged, not everted, their ventral surfaces not vertical, their most prominent points separated by less than 25% (13 to 24%); length over curve not less than 115% (115 to 134%); usually less than width over curve; vertical distance from lower surface of plastron to lower edge of lateral marginals great, 6 to 10%; general size large, straight length to 49.5 inches; plastron moderately long, median length 66 to 87%; plates generally striated; pectorals forming a suture on median line; eighth marginal plate not reduced, with well developed superior border; lower jaw and throat not marked with yellow.

## TABLE OF MEASUREMENTS OF IGUANA COVE TORTOISES.

| Number | Sex | Straight | | | Curved | | | | Width 2d to 3d marginals | Per Cent | Height | | | | Height to marginals | Per Cent | Plastron | Per Cent | Fore Limb | Per Cent | Hind Limb | Per Cent | Axilla to Elbow | Per Cent | Neck | Per Cent | Tail | Per Cent |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Length | Width | Per Cent | Length | Per Cent | Width | Per Cent | | | Middle | Per Cent | Front | Per Cent | | | | | | | | | | | | | | |
| 8179 | ♂ | 43. | 31.75 | 74 | 49.5 | 115 | 53.3 | 124 | 21.5 | 52 | 22.8 | 56 | 15.4 | 36 | 3.5 | 8 | 32. | 74 | | | | | | | | | | |
| 8178 | ♂ | 41. | 32. | 78 | 49.8 | 121 | 54.5 | 133 | 23.4 | 57 | 22.7 | 55 | 17. | 41 | 2.8 | 7 | 32.25 | 79 | | | | | | | | | | |
| 8180 | ♂ | 38.5 | 30.5 | 79 | 46. | 119 | 52. | 135 | 20. | 52 | 20.8 | 54 | 16.8 | 44 | 2.5 | 6 | 25.25 | 66 | 22.4 | 58 | 21.2 | 55 | 12.6 | 33 | 26. | 68 | 4. | 10 |
| 8176 | ♂ | 37.2 | 27. | 73 | 45.25 | 122 | 43.1 | 116 | 20.5 | 55 | 18.1 | 49 | 13.6 | 37 | 3. | 8 | 25.6 | 69 | 17.4 | 47 | 16. | 43 | 11.6 | 31 | 18.8 | 51 | 5.8 | 13 |
| 8175 | ♂ | 35.25 | 27.3 | 77 | 44. | 125 | 45.8 | 130 | 19.5 | 55 | 18.8 | 53 | 15.1 | 43 | 2.5 | 7 | 28.7 | 81 | 18. | 51 | 14.8 | 42 | 10.8 | 31 | 19. | 54 | 3.6 | 10 |
| 8177 | ♂ | 34.3 | 29.75 | 87 | 43.3 | 126 | 47.4 | 138 | 19.7 | 57 | 19.8 | 58 | 14.5 | 42 | 3.2 | 9 | 28. | 82 | 17.2 | 50 | 13.6 | 40 | 9.6 | 28 | 18. | 52 | 4. | 12 |

## TABLE OF MEASUREMENTS OF TORTOISES FROM OLD COBOS SETTLEMENT AND VICINITY, ALBEMARLE.

| Number | Sex | Straight | | | Curved | | | | Width 2d to 3d marginals | Per Cent | Height | | | | Height to marginals | Per Cent | Plastron | Per Cent | Fore Limb | Per Cent | Hind Limb | Per Cent | Axilla to Elbow | Per Cent | Neck | Per Cent | Tail | Per Cent |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Length | Width | Per Cent | Length | Per Cent | Width | Per Cent | | | Middle | Per Cent | Front | Per Cent | | | | | | | | | | | | | | |
| 8186 | ♂ | 40.5 | 29. | 71.6 | 52.25 | 129 | 49.5 | 122 | 20.5 | 51 | 20.5 | 51 | 13.5 | 33 | 2.25 | 6 | 31.25 | 77 | 17.4 | 43 | 16.8 | 41 | 9.6 | 24 | 19.8 | 49 | 5.4 | 13 |
| 8390 | ♂ | 33.6 | 26.3 | 77 | 42.2 | 126 | 43. | 128 | 17.6 | 52 | 17.7 | 53 | 11.3 | 34 | 2.8 | 8 | 26.6 | 79 | | | | | | | | | | |
| 8187 | ♂ | 33.3 | 27.2 | 82 | 41.6 | 125 | 44. | 132 | 16.1 | 48 | 18.4 | 55 | 11.2 | 34 | 3. | 9 | 26.2 | 79 | 16. | 48 | 14.4 | 43 | 8.8 | 26 | | | 4.8 | 14 |
| 8185 | ♂ | 32. | 25.8 | 81 | 40.5 | 126 | 42.1 | 132 | 18.7 | 58 | 17.8 | 56 | 12.3 | 38 | 2.6 | 8 | 26. | 81 | 16.8 | 53 | 14.8 | 46 | 8. | 25 | 16. | 50 | 3.6 | 11 |
| 8184 | ♀ | 29.3 | 22.5 | 78 | 38.5 | 131 | 37.7 | 129 | 15.8 | 54 | 15.9 | 54 | 11.3 | 39 | 2.7 | 9 | 24.3 | 83 | 14. | 48 | 12.8 | 44 | 6. | 20 | 15.8 | 54 | 2.2 | 8 |
| 8389 | ♀ | 30.2 | 24.5 | 81 | 39.2 | 130 | 40.2 | 133 | 16.6 | 55 | 16.8 | 56 | 10.6 | 35 | 2.25 | 7 | 24.5 | 81 | | | | | | | | | | |
| 8387 | ♀ | 29.2 | 23.8 | 82 | 37.5 | 128 | 39. | 134 | 16.1 | 55 | 17.1 | 59 | 10. | 37 | 2.6 | 9 | 25.2 | 86 | | | | | | | | | | |
| 8182 | ♀ | 28.5 | 22.9 | 80 | 37.2 | 131 | 38. | 133 | 15.4 | 54 | 16. | 56 | 9.4 | 33 | 2.3 | 8 | 22.25 | 78 | 14.8 | 52 | 13.6 | 48 | 6.4 | 22 | 13. | 46 | 2.6 | 9 |
| 8181 | ♀ | 28.3 | 22.75 | 80 | 36. | 127 | 37.9 | 134 | 14.6 | 52 | 15.5 | 55 | 9.8 | 35 | 1.9 | 7 | 23.5 | 83 | 14. | 49 | 13.2 | 47 | 6.4 | 23 | 12.4 | 44 | 1.8 | 6 |
| 8388 | ♀ | 26.3 | 21.2 | 81 | 34.3 | 130 | 34.35 | 130 | 14. | 53 | 14.2 | 54 | 9.3 | 35 | 2.2 | 8 | 20.8 | 79 | | | | | | | | | | |

## TABLE OF MEASUREMENTS OF SOUTH ALBEMARLE TORTOISES.

| Number | Sex | Straight | | | Curved | | | | Width 2d to 3d marginals | | Height | | | | Height to marginals | | Plastron | | Fore Limb | | Hind Limb | | Axilla to Elbow | | Neck | | Tail | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Length | Width | Per Cent | Length | Per Cent | Width | Per Cent | | Per Cent | Middle | Per Cent | Front | Per Cent | | Per Cent | | Per Cent | | Per Cent | | Per Cent | | Per Cent | | Per Cent | | Per Cent |
| 8196 | ♂ | 33.2 | 26.5 | 80 | 43.3 | 130 | 43.3 | 130 | 19.7 | 59 | 18.3 | 55 | 11. | 33 | 2.4 | 7 | 25.25 | 76 | 16. | 48 | 15.2 | 46 | 8.8 | 27 | 16.8 | 51 | 4. | 12 |
| 8188 | ♂ | 33. | 26.1 | 79 | 41.6 | 126 | 42.4 | 128 | 17.2 | 52 | 17.8 | 54 | 10.4 | 32 | 2.6 | 8 | 27.25 | 83 | 14.4 | 44 | 11.6 | 35 | 7.4 | 22 | 15.6 | 47 | 3.6 | 11 |
| 8211 | ♂ | 27.9 | 22. | 79 | 35.1 | 126 | 36. | 129 | 14.3 | 51 | 14.9 | 53 | 9.2 | 33 | 2.1 | 8 | 21.1 | 76 | | | | | | | | | | |
| 8207 | ♂ | 26.8 | 22.25 | 83 | 34.5 | 128 | 34.8 | 130 | 11.6 | 44 | 14.3 | 53 | 10. | 37 | 2.7 | 10 | 22.2 | 82 | 13. | 49 | 12. | 45 | 7.2 | 27 | 14.4 | 54 | 2.8 | 10 |
| 8252 | ♂ | 26.75 | 21.2 | 79 | | | 33. | 123 | 14. | 52 | 13.6 | 51 | 9.1 | 34 | 2.25 | 8 | 21. | 79 | | | | | | | | | | |
| 8208 | ♂ | 25. | 20.6 | 82 | 32.2 | 129 | 32.8 | 131 | 13.5 | 54 | 13.6 | 54 | 8.6 | 34 | 2. | 8 | 20.1 | 80 | 12.6 | 50 | 11.2 | 45 | | | 13.6 | 54 | 2.2 | 9 |
| 8236 | ♂ | 24.4 | 20.45 | 84 | 31.5 | 129 | 33.6 | 138 | 12.7 | 52 | 13.3 | 55 | 9. | 37 | 1.6 | 7 | 20.2 | 83 | | | | | | | | | | |
| 8222 | ♂ | 24.2 | 18.75 | 77 | 29.8 | 123 | 30.4 | 126 | 12. | 50 | 12.25 | 51 | 8.5 | 35 | 1.6 | 7 | 19.1 | 79 | | | | | | | | | | |
| 8254 | ♂ | 24.1 | 18.6 | 78 | 31.6 | 131 | 31.2 | 129 | 12.4 | 51 | 13.4 | 56 | 8.25 | 34 | 2.2 | 9 | 19. | 79 | | | | | | | | | | |
| 8255 | ♂ | 24. | 19. | 79 | 31. | 129 | 30. | 125 | 11.8 | 49 | 12.5 | 52 | 8.7 | 36 | 2.2 | 9 | 20.3 | 85 | | | | | | | | | | |
| 8193 | ♀ | 31.2 | 24.9 | 80 | 39.6 | 127 | 40.25 | 129 | 15.8 | 51 | 16.9 | 54 | 11. | 35 | 2.5 | 8 | 24.8 | 79 | | | | | | | | | | |
| 8418 | ♀ | 30. | 22.5 | 75 | 37.4 | 125 | 37. | 123 | 15.5 | 52 | 15.5 | 52 | 9.25 | 31 | 2.5 | 8 | 24.1 | 80 | | | | | | | | | | |
| 8264 | ♀ | 29.6 | 23.1 | 78 | 36.75 | 124 | 37.2 | 126 | 14.1 | 48 | 15.4 | 52 | 10.1 | 34 | 2.5 | 8 | 21. | 71 | 12.8 | 43 | 11.2 | 38 | 6.8 | 23 | 14.4 | 49 | 2.4 | 8 |
| 8270 | ♀ | 29.2 | 23.4 | 80 | 37.25 | 128 | 38.25 | 131 | 15.25 | 52 | 15.9 | 54 | 11.2 | 38 | 3. | 10 | 24.25 | 83 | | | | | | | | | | |
| 8192 | ♀ | 28.75 | 23.8 | 84 | 36.4 | 127 | 38.25 | 133 | 14.3 | 50 | 15.5 | 54 | 11.2 | 39 | 2. | 7 | 23.25 | 82 | 12. | 42 | 11.2 | 39 | | | 13.2 | 46 | 2. | 7 |
| 8198 | ♀ | 28.75 | 22.5 | 79 | 37.4 | 130 | 40.2 | 140 | 14.3 | 50 | 16.4 | 57 | 11.5 | 40 | 2.4 | 8 | 21.8 | 76 | 15.2 | 53 | 12.4 | 43 | 6.8 | 24 | 15.6 | 54 | 2. | 7 |
| 8205 | ♀ | 28.7 | 22.4 | 78 | 35.75 | 125 | 36.4 | 127 | 14.9 | 52 | 15.1 | 53 | 10.25 | 36 | 2.5 | 9 | 22.2 | 77 | 14. | 49 | 13.2 | 46 | 6.4 | 22 | 15.2 | 53 | 2.4 | 8 |
| 8203 | ♀ | 28.4 | 22.75 | 80 | 35.1 | 124 | 36.9 | 130 | 15.2 | 54 | 15. | 52 | 9.5 | 33 | 2.2 | 8 | 23.2 | 82 | | | | | | | | | | |
| | ♀ | 28. | 21.6 | 77 | 36.3 | 130 | 36.6 | 131 | 15. | 54 | 14.6 | 52 | 9.8 | 35 | 2. | 7 | 23.6 | 84 | | | | | | | | | | |

TABLE OF MEASUREMENTS OF SOUTH ALBEMARLE TORTOISES—Continued.

| | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8201 | ♀ | 28. | 21.25 | 76 | 36. | 129 | 35. | 125 | 14.5 | 52 | 14.75 | 53 | 11. | 39 | 2.7 | 10 | 22.75 | 81 | 13.6 | 49 | 13.2 | 47 | 8. | 29 | 14.4 | 52 | 2.2 | 10 |
| 8204 | ♀ | 27.7 | 22.3 | 81 | 34.9 | 126 | 35.6 | 129 | 14.71 | 53 | 14.9 | 54 | 9.2 | 33 | 2.5 | 9 | 21.8 | 79 | 13.2 | 48 | 12.4 | 45 | 8.4 | 30 | 14. | 54 | 3.2 | 11 |
| 8257 | ♀ | 27.5 | 21.25 | 77 | 35. | 127 | 35.25 | 128 | 14.75 | 54 | 14.75 | 54 | 10. | 36 | 2.25 | 8 | 22.5 | 82 | | | | | | | | | | |
| 8202 | ♀ | 27.2 | 20.6 | 76 | 33.6 | 124 | 35.6 | 131 | 13.2 | 49 | 14.25 | 52 | 9.7 | 36 | 1.8 | 7 | 21.1 | 78 | 13.6 | 50 | 12.8 | 47 | 7.4 | 27 | | | 2.1 | 8 |
| 8241 | ♀ | 27.1 | 21.5 | 79 | 34.2 | 126 | 35.1 | 130 | 14. | 52 | 14.5 | 53 | 9.4 | 35 | 2. | 7 | 22.5 | 83 | | | | | | | | | | |
| 8200 | ♀ | 27. | 21.5 | 80 | 33.5 | 124 | 34.5 | 128 | 14.25 | 53 | 13.8 | 51 | 10.1 | 37 | 1.8 | 7 | 22. | 81 | 13.2 | 49 | 9. | 33 | | | 13.6 | 50 | 1.72 | 6 |
| 8246 | ♀ | 27. | 20.5 | 76 | 34.6 | 128 | 34.25 | 126 | 14.6 | 54 | 14.2 | 53 | 8.3 | 31 | 2.3 | 9 | 21. | 78 | | | | | | | | | | |
| 8258 | ♀ | 26.75 | 21.1 | 79 | 34.4 | 129 | 37.1 | 139 | 15.4 | 58 | 15. | 56 | 10. | 37 | 1.75 | 7 | 22. | 82 | | | | | | | | | | |
| 8231 | ♀ | 26.4 | 20.9 | 75 | 34.75 | 132 | 34.2 | 126 | | | 14.4 | 55 | 9.2 | 35 | 2.4 | 9 | 21. | 80 | | | | | | | | | | |
| 8243 | ♀ | 26. | 20.75 | 80 | 34. | 131 | 34.6 | 133 | 13.1 | 50 | 14.25 | 55 | 9.6 | 37 | 1.8 | 7 | 21. | 81 | | | | | | | | | | |
| 8219 | ♀ | 25.9 | 20.8 | 80 | 33.75 | 130 | 34. | 131 | 14. | 58 | 13.8 | 53 | 8.2 | 32 | 1.9 | 7 | 21. | 81 | | | | | | | | | | |
| 8261 | ♀ | 25.8 | 20.7 | 80 | 34.25 | 133 | 35. | 136 | 13.8 | 53 | 14.6 | 57 | 9.1 | 35 | 2.5 | 10 | 20.7 | 80 | | | | | | | | | | |
| 8223 | ♀ | 25.8 | 20.25 | 78 | 32.7 | 127 | 33.8 | 131 | 13.5 | 52 | 14.25 | 55 | 8.8 | 34 | 2.3 | 9 | 20.8 | 81 | | | | | | | | | | |
| 8238 | ♀ | 25.75 | 19.2 | 75 | 32. | 124 | 33.5 | 130 | 13.4 | 52 | 13.8 | 54 | 8.3 | 32 | 1.8 | 7 | 21. | 82 | | | | | | | | | | |
| 8216 | ♀ | 25.1 | 20.2 | 80 | 32.1 | 128 | 32.8 | 131 | 12.5 | 50 | 13.6 | 54 | 9.2 | 37 | 2.4 | 10 | 20.6 | 82 | | | | | | | | | | |
| 8227 | ♀ | 25. | 19. | 76 | 33.5 | 134 | 34. | 136 | 13.7 | 55 | 14.25 | 57 | 9.5 | 38 | 2.1 | 8 | 21.25 | 85 | | | | | | | | | | |
| 8242 | ♀ | 24.8 | 19.6 | 79 | 31. | 125 | 31.6 | 127 | 12.3 | 50 | 13. | 52 | 7.7 | 31 | 2.3 | 9 | 19.8 | 80 | | | | | | | | | | |
| 8260 | ♀ | 24.75 | 19.75 | 81 | 31.5 | 127 | 33.5 | 131 | 13. | 53 | 13.5 | 55 | 8.75 | 35 | 1.75 | 7 | 19.5 | 79 | | | | | | | | | | |
| 8228 | ♀ | 24.6 | 20.7 | 84 | 31.5 | 128 | 32.3 | 131 | 13.25 | 54 | 13.4 | 55 | 8.2 | 33 | 2. | 8 | 20.4 | 83 | | | | | | | | | | |
| 8235 | ♀ | 24.6 | 19.75 | 79 | 30.5 | 124 | 31. | 126 | 13. | 53 | 12.75 | 51 | 8.1 | 33 | 2. | 8 | 20.4 | 82 | | | | | | | | | | |
| 8221 | ♀ | 24.5 | 19.8 | 83 | 31.5 | 129 | 31.7 | 129 | 11.9 | 49 | 13.1 | 53 | 8.5 | 35 | 2. | 8 | 19.6 | 80 | | | | | | | | | | |
| 8213 | ♀ | 24. | 19.9 | 83 | 30.2 | 126 | 31. | 129 | 12.61 | 53 | 12.75 | 53 | 8. | 33 | 2.2 | 9 | 19.6 | 82 | | | | | | | | | | |
| 8263 | ♀ | 24. | 19.1 | 80 | 31. | 129 | 31. | 129 | 12.25 | 51 | 13. | 54 | 8.5 | 35 | 2.25 | 9 | 19.6 | 82 | | | | | | | | | | |
| 8195 | ♀ | 24. | 19. | 79 | 32. | 133 | 33.3 | 139 | 12.61 | 53 | 13.75 | 57 | 8.4 | 35 | 2. | 8 | 20.8 | 87 | 12. | 50 | 10.8 | 45 | 5.4 | 23 | 12.6 | 53 | 1.9 | 8 |
| 8253 | ♀ | 23.7 | 20. | 84 | 31.7 | 134 | 30.6 | 125 | 12. | 51 | 13.4 | 57 | 8.6 | 36 | 2. | 8 | 20.3 | 86 | | | | | | | | | | |
| 8183 | ♀ | 21.25 | 17.25 | 81 | 27.5 | 129 | 27.75 | 131 | 11.5 | 54 | 11.25 | 53 | 7.1 | 33 | 2.9 | 9 | 18. | 85 | 6.4 | 30 | 6. | 28 | 5.6 | 26 | 10.6 | 50 | 2.2 | 10 |
| 8273 | ? | 3.3 | 2.8 | | 3.85 | | 3.85 | | | | 1.6 | | | | | | 2.81 | | | | | | | | | | | |

*General remarks.*—See also remarks under *T. güntheri*. *Testudo vicina* attains a very large size. The shell usually is quite thick and heavy. The females are dome-shaped, while the adult males have the front of the carapace considerably elevated. In this elevation of the front of the carapace these tortoises resemble the Tagus Cove and James Island species. In *Testudo darwini* the central portion of the back rises higher than in *T. vicina*. *Testudo microphyes* is a smoother, lighter race, in which the back is nearly flat. Our only specimen from Jervis Island is nearly intermediate between *T. darwini* and *T. vicina*.

Nine eggs (No. 8425) from tortoise No. 8388, collected Nov. 2, 1905, about eight miles west of Vilamil, Albemarle Island, measure 2.44x2, 2.30x2.20, 2.25x2.12, 2.25x2.10, 2.20x2.10, 2.20x2.08, 2.18x2.10, 2.10x1.95, and 2.08x2.04 inches.

*Field Notes.*—March 16, 1906.—Sailing to get around to Iguana Cove. Busy all day skinning tortoises, all hands helping in the morning. There is hardly any wind, and we are drifting with the current. We are nearly abeam of the mountain near the Cove. It rises very abruptly, and seems to be well covered with brush. Several black lava-flows can be seen, and the plateau to the eastward is all new lava.

March 17, 1906.—Anchored at noon in Iguana Cove. It is a very bad anchorage, having deep water and heavy swells, with not much room for the ship to swing. The coast is heavily wooded with brush and trees, as at Cocos Island, and is very abrupt, with many steep cliffs visible on the mountain side. Beck, King, Williams, and I went down the coast to the southward about two miles, and landed on a rocky beach to hunt for tortoises. The country was covered with thick brush, and the tortoise trails went along underneath, so that quite often one had to go on hands and knees. The place where we hunted was a small flat, where cactus and tall grass were fairly abundant. We found three tortoises; all males. We drove two of these down to the beach, as they were only seventy-five or a hundred yards from the shore. They were too large to get them into the boat. We failed to get them in while the boat was on the beach. Then we towed one out and tried to get him in; but as the boat was in the breakers and half full of

water it sank when we got the tortoise aboard, and he floated off while we struggled in the water. Luckily, King was on the beach, for he cannot swim. Williams struck out for shore, while Beck and I tried to turn the boat over, for by this time the swells had rolled it bottom up. The current was too strong for Williams to make the beach, so he came back to the boat. With his assistance we righted it, and, getting two oars that were stuck under the seats, Beck sculled and I pulled till we got near the rocks. Then I swam ashore with the painter and pulled the boat in, so Beck and Williams got ashore. We tried to pull the boat along the rocks to the beach, but the swell was so heavy that it was smashed into a thousand pieces. All that we saved was the painter and two oars. I had left most of my clothes on the beach, so only lost a shirt and a hat. Williams lost all of his collecting outfit, canteen, etc.

By this time it was five o'clock, so we put on what clothes we had left, and made back along the coast, while our tortoises were drifting away out at sea. We had anything but a pleasant walk back. I had lost my shirt, and the thorns and cactus spines felt anything but pleasant. We traveled on till about eight o'clock, when we saw a light on the water and hailed the other boat. The boys on the ship, seeing nothing of us, had put off to the rescue in the second boat with some ropes and life preservers. They soon found out that we were all safe. We told them to go to the Cove and pick us up, as the surf was too high elsewhere. We got to the Cove about the same time as the boat, and got safely aboard a little after nine. Beck says he is going to get what tortoises he can, and pull out as soon as possible. All hands are anxious to leave, and I won't shed any tears myself.

March 18, 1906.—Still anchored at the Cove. We sighted the two tortoises drifting down the coast and, putting out the boat, rescued both of them. One was badly battered up, and evidently had been knocked up against the rocks by the surf. We also picked up several pieces of our skiff. The tortoises had been in the water about eighteen hours, and seemed none the worse for it. They would stick their heads out of the water occasionally and look around while they floated along like corks, nearly all the carapace being out of the water. We still keep on the lookout for wreckage, and

expect to go back to the same place tomorrow for the other tortoise, and more if we find them.

March 19, 1906.—We went down the coast to the place where we lost the boat. The tortoises come down to the cactus trees about fifty to seventy-five yards from the bluffs, and work around in the flat country near the coast. We found three. Beck took two pictures of one of them. So far we have brought all our Iguana Cove tortoises on board alive, but I think we shall have to skin a large one tomorrow, and put two over the cliffs into the sea and tow them to the ship. King did not care to go with us today, our experience on Saturday having been too much for him, so he went ashore at Iguana Cove to hunt tortoises. He failed to find any signs whatever. Hunter says he saw an old watering place about seven hundred feet up the mountain, but the grass had grown over all the trails, and there were no fresh signs of tortoises anywhere. The tortoises taken have numerous blood-sucking ticks along the cracks between the plastral plates.

March 20, 1906.—Went down the coast to get the tortoises we have tied up. We put them all off into the sea and towed them to the ship. Two of them were badly battered up by the surf. We had to lower them over the cliffs with ropes and let them drift out to the boat. Beck took several pictures of the operation. It took up about the whole day. One of the tortoises that came floating by on Sunday morning died the night of the 19th of the injuries it had received. Its stomach contained cactus and grass. We expect to sail tomorrow, as the place is rather dangerous to anchor, and all hands will feel safer out of here.

March 21, 1906.—Worked on board all day, skinning two tortoises that died from injuries received in collecting them. We sailed for Narborough at 10:30 A. M.

## **Testudo wallacei** Rothschild

Jervis Island Tortoise

Plates 111 and 112.

*Testudo wallacei* Rothschild, Novit. Zool., IX, 1902, p. 619; Heller, Proc. Washington Acad. Sci., V, 1903, p. 54; Siebenrock, Zool. Jahrb., Suppl. X, 3, 1909, p. 533.

*Type specimen.*—In the Rothschild Museum at Tring, England. Carapace, probably of adult male. Straight length 32.25 inches. Purchased from the Bullock collection. Origin unknown.

*Distribution.*—Jervis Island, Galapagos Archipelago.

*Material.*—Our collection includes the skin of one adult male and some fragments of bone from another specimen.

*Diagnosis.*—No nuchal; gulars paired; fourth cervical vertebra biconvex; front of carapace moderately high in males, but considerably lower than middle height; height at nuchal notch less than 45% (37%) of straight length; difference between percentages of heights at third vertebral and at nuchal notch more than 13 (17); carapace not saddle-shaped, not narrow anteriorly, width at margin of junction of second and third marginals not less than 44% (54%); first marginals not greatly enlarged, not everted, their ventral surfaces not vertical; length over curve 134%, greater than width over curve (129%); vertical distance from lower surface of plastron to lower edge of lateral marginals great, 8%; general size large, straight length 36.2 inches; plastron moderately long, median length 81%; pectorals forming a suture on median line; eighth marginal plate not reduced, with well-developed superior border; lower jaw and throat not marked with yellow.

TABLE OF MEASUREMENTS OF JERVIS ISLAND TORTOISE

| Number | Sex | Straight | | Curved | | Height | | | | Width 2d to 3d marginals | | Height to marginals | | Plastron | | Fore Limb | | Hind Limb | | Axilla to Elbow | | Neck | | Tail | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Length | Width | Length | Width | Middle | | Front | | | | | | | | | | | | | | | | | |
| | | | | | | | Per Cent | | Per Cent | | Per Cent | | Per Cent | | Per Cent | | Per Cent | | Per Cent | | Per Cent | | Per Cent | | Per Cent |
| 8134 | ♀ | 36.2 | 28.5 | 78.7 | 48.6 | 134 | | 46.75 | | 129 | | 19.6 | | 54 | | 19.5 | | 53.8 | | 12.9 | | 36.6 | | 2.9 | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | |

*General remarks.*—The single tortoise at hand from Jervis Island is very similar in shape to the large males of *Testudo vicina* from Iguana Cove. The length over the curve in the Jervis Island tortoise is greater than in those from Iguana Cove, so that the curved width is less than the curved length. The front height is less than in *T. darwini* of James Island, making the difference between front and middle heights greater. Upon the whole it may be said that the Jervis tortoise is intermediate between those of James Island and Iguana Cove, and that it seems to resemble the latter a little more than the former. My reasons for using the name *T. wallacei* for this tortoise are stated in the introductory portion of this paper (see page——).

*Field Notes*—December 18, 1905.—Left Duncan Island this morning, and made Jervis early in the afternoon. Worked on Duncan tortoises all day and got the mess straightened out as well as possible. Expect to get ashore on Jervis tomorrow. Gifford says he saw a lot of old tortoise trails and old droppings. The island is very steep, and is composed of red-lava blocks. The beach is all red-lava sand or dust, and trees in the lagoon are visible from the ship.

December 19, 1905.—Went ashore on Jervis. A fine sand beach with a lagoon back of it. The island is covered with red-lava blocks and ashes. The highest peak is 1050 feet by barometer. I saw old tortoise trails in the ashes, one of which ran up a valley clear to the top. Saw lots of old dung that apparently had been rained on, as it was bleached out rather white.

December 20, 1905.—Mr. Beck went ashore on Jervis and found a large tortoise on the north side in a small valley. It looks like the south Albemarle ones.

## **Testudo porteri** Rothschild

Indefatigable Island Tortoise.

Plates 113 to 121.

? *Testudo indica* (part), Gray, [*nec* Perrault, 1676] Syn. Rept., 1831, p. 9; Gray, Cat. Tort. Croc. Amphis. Brit. Mus., 1844, p. 5; Gray, Cat. Shield Rept. Brit. Mus., I, 1855, p. 6; Gray, Suppl. Cat. Shield Rept. Brit. Mus., 1870, p. 5; Sowerby & Lear, Tortoises, 1872, pl. VI.

? *Testudo nigrita,* Dum. & Bibr., Erpét. Génér., II, 1835, p. 80; Günther, Trans. Royal Soc. Lond., CLXV, 1875, p. 267, pls. 33 fig. B, 35 fig. C, 37 fig. D, 38 fig. D, 39 fig. D; Günther, Gigantic Land Tortoises Brit. Mus., 1877, p. 69, pls. XXX fig. B, XXXI*B* fig. C., XLII fig. D, XLIII fig. D, XLIV fig. D; Boulenger, Cat. Chelonians Brit. Mus., 1889, p. 169; Kammerer, Blätt. Aquar.—Terr.—Kunde, XIX, 1898, p. 737, figs. 1-2 [*T. vicina?*]; Waite, Rec. Austral Mus., III, 1891, p. 95; Heller, Proc. Washington Acad. V, 1903, p. 53; Siebenrock, Zool. Jahrb., Suppl. X, 3, 1909, p. 531.

? *Testudo planiceps,* Gray, Cat. Shield Rept. Brit. Mus, 1855, p. 6, pl. XXXIV; Gray, Suppl. Cat. Shield Rept. Brit. Mus., 1870, p. 5; *Elephantopus planiceps,* Gray, Proc. Zool. Soc. Lond., 1873, p. 724.

? *Testudo elephantina,* Strauch, [*nec* Duméril & Bibron] Mém. Ac. St. Petersb., (7), V, No. 7, 1862, p. 83.

? *Testudo elephantopus,* Gray, [*nec* Harlan] Proc. Zool. Soc. Lond., 1870, p. 708, pl. XII, (part); Gray, Append. Cat. Shield Rept. Brit. Mus., 1872, p. 3.

*Testudo porteri* Rothschild, Novit. Zool., X, 1903, p. 119; Siebenrock, Zool. Jahrb., Suppl. X, 3, 1909, p. 532.

*Type specimens.—Testudo nigrita:* Paris Museum. Very young. Origin unknown. And Museum Royal College of Surgeons, London. Young. Straight length 22 inches. Origin unknown.

*Testudo planiceps:* British Museum. Skull of adult. Origin unknown.

*Testudo porteri:* Tring Museum, England. Adult. Curved length 51.5 inches. Taken on Indefatigable Island, by R. H. Beck.

*Distribution.*—Indefatigable Island, Galapagos Archipelago.

*Material.*—In the Tring Museum are two adult males, two adult females, one young, and six skulls. The species also is represented in the collection in Vienna. The California Academy has twenty-three of both sexes and various sizes.

*Diagnosis.*—No nuchal; gulars paired; fourth cervical vertebra biconvex; front of carapace low, from 18 to 28% lower than middle; height at nuchal notch not more than 40% (30

to 40%) of straight length; difference between percentages of heights at third vertebral and at nuchal notch more than 17 (18 to 28); carapace dome-shaped, very broad anteriorly, width at margin of junction of second and third marginals not less than 53% (53 to 71%); first marginals not everted, their most prominent points separated by less than 25% (18 to 24%); length over curve not less than 125% (126 to 141%), usually greater than width over curve; vertical distance from lower surface of plastron to lower edge of lateral marginals great, 7 to 11%; general size large, straight length to 41.4 inches; plastron long, 77 to 92%; plates generally striated; pectorals forming a suture on median line; eighth marginal plate not reduced, with a considerable superior border; lower jaw and throat in males not marked with yellow.

## TABLE OF MEASUREMENTS OF INDEFATIGABLE ISLAND TORTOISES.

| Number | Sex | Straight | | | Curved | | | | Width 2nd and 3d Marginals | Per Cent | Height | | | | Height to Marginals | Per Cent | Plastron | Per Cent | Fore Limb | Per Cent | Hind Limb | Per Cent | Axilla to Elbow | Per Cent | Neck | Per Cent | Tail | Per Cent |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Length | Width | Per Cent | Length | Per Cent | Width | Per Cent | | | Middle | Per Cent | Front | Per Cent | | | | | | | | | | | | | | |
| 8289 | ♂ | 41.4 | 35.2 | 85 | 53.4 | 129 | 53.1 | 128 | 24.3 | 59 | 22.8 | 55 | 13.5 | 33 | 3.5 | 8 | 34.8 | 84 | | | | | | | | | | |
| 8282 | ♂ | 40.3 | 32.1 | 80 | 53.7 | 133 | 53.3 | 132 | 25. | 62 | 22.6 | 56 | 14. | 35 | 3.2 | 8 | 32.75 | 81 | | | | | | | | | | |
| 8284 | ♂ | 39.6 | 33.8 | 85 | 54.5 | 138 | 55.1 | 139 | 28.2 | 71 | 23.1 | 58 | 12.3 | 31 | 3.4 | 9 | 32.5 | 81 | 19. | 48 | 18. | 45 | 9.2 | 23 | 21.4 | 56 | 2.6 | 7 |
| 8290 | ♂ | 39.6 | 31.5 | 80 | 52. | 131 | 54.6 | 138 | 23.5 | 59 | 22.5 | 57 | 13.5 | 34 | 2.8 | 7 | 32.1 | 81 | | | | | | | | | | |
| 8281 | ♂ | 39. | 29.3 | 75 | 50.8 | 130 | 50.8 | 130 | 21.2 | 54 | 22.4 | 57 | 12. | 31 | 3. | 8 | 30. | 77 | | | | | | | | | | |
| 8275 | ♂ | 38.25 | 33.3 | 87 | 53.9 | 141 | 56. | 146 | 23.5 | 61 | 23.3 | 61 | 12.75 | 33 | 2.7 | 7 | 31.1 | 82 | 18.4 | 48 | 17.6 | 46 | 9.2 | 24 | | | 6. | 16 |
| 8288 | ♂ | 37.5 | 30.25 | 81 | 48.5 | 129 | 51.5 | 137 | 22. | 59 | 22.5 | 60 | 14.5 | 36 | 3. | 8 | 30.5 | 81 | | | | | | | | | | |
| 8285 | ♂ | 35.5 | 32. | 90 | 48.6 | 137 | 50. | 141 | 21.1 | 59 | 20.7 | 58 | 10.75 | 30 | 2.7 | 8 | 29.5 | 83 | | | | | | | | | | |
| 8383 | ♂ | 25.3 | 22. | 87 | 33.4 | 132 | 34.2 | 135 | 14.2 | 56 | 14.7 | 58 | 8.5 | 34 | 2.4 | 9 | 22. | 87 | | | | | | | | | | |
| 8386 | ♂ | 23.6 | 19.8 | 84 | 30.8 | 126 | 29.5 | 125 | 13. | 55 | 13.1 | 56 | 8.9 | 38 | 2.6 | 11 | 21.6 | 92 | 14.2 | 60 | 12. | 51 | 6.8 | 29 | 14. | 59 | 2.2 | 9 |
| 8286 | ♀ | 35.8 | 29.5 | 83 | 45.6 | 127 | 48.75 | 136 | 19. | 53 | 20.8 | 58 | 11.6 | 32 | 2.75 | 8 | 28.8 | 80 | | | | | | | | | | |
| 8287 | ♀ | 31. | 25.5 | 82 | 39.8 | 128 | 41.2 | 133 | 16.6 | 54 | 17.75 | 57 | 10.5 | 34 | 2.5 | 8 | 25.5 | 82 | 15.2 | 49 | 14.8 | 48 | | | 14.8 | 48 | 2.4 | 8 |
| 8277 | ♀ | 30.2 | 25.8 | 85 | 40. | 132 | 44.1 | 146 | 17.2 | 57 | 19.1 | 63 | 11.6 | 38 | 2.8 | 9 | 26.2 | 87 | | | | | | | | | | |
| 8280 | ♀ | 29.8 | 25.3 | 85 | 40.25 | 135 | 42.2 | 142 | 16.3 | 55 | 18.5 | 62 | 10.6 | 36 | 3. | 10 | 26.3 | 88 | 12.8 | 43 | 11.8 | 40 | 7.6 | 26 | 13.6 | 46 | 1.4 | 5 |
| 8278 | ♀ | 29.2 | 25.1 | 86 | 38.1 | 130 | 40.75 | 140 | 16.7 | 57 | 17.9 | 61 | 9.6 | 33 | 3. | 10 | 25.2 | 86 | | | | | | | | | | |
| 8279 | ♀ | 29.1 | 25.5 | 84 | 39.75 | 137 | 42. | 144 | 17.1 | 59 | 18.3 | 63 | 10.2 | 35 | 2.9 | 10 | 26. | 89 | | | | | | | | | | |
| 8276 | ♀ | 28.75 | 25. | 87 | 38.75 | 134 | 41. | 142 | 17.2 | 60 | 17.5 | 61 | 10.6 | 37 | 2.5 | 9 | 25.15 | 87 | | | | | | | | | | |
| 8384 | ♀ | 28.4 | 25.3 | 89 | 36.8 | 130 | 39. | 137 | 17. | 60 | 15.9 | 56 | 10.7 | 38 | 2.3 | 8 | 24. | 85 | | | | | | | | | | |
| 8274 | ♀ | 28.1 | 24.2 | 86 | 38.4 | 136 | 40.5 | 144 | 16.2 | 58 | 17.6 | 63 | 11.3 | 40 | 2.7 | 10 | 25. | 89 | 13.8 | 49 | 12.8 | 46 | 8.4 | 30 | 16.4 | 58 | 2. | 7 |
| 8283 | ♀ | 26.3 | 21. | 84 | 33.1 | 126 | 32. | 122 | 13.9 | 53 | 14.3 | 54 | 8.5 | 32 | 2.75 | 10 | 23.1 | 88 | | | | | | | | | | |
| 8385 | ♀ | 26. | 21.5 | 83 | 32.5 | 125 | 33. | 127 | 14.2 | 55 | 14.5 | 56 | 8.75 | 34 | 3.5 | 13 | 23.1 | 89 | | | | | | | | | | |
| 8382 | ♀ | 21.75 | 19. | 87 | 30. | 138 | 29. | 133 | 12.4 | 57 | 12.9 | 59 | 7.6 | 35 | 2.3 | 11 | 20. | 92 | | | | | | | | | | |
| 8419 | ♀ ? | 8.5 | 7.1 | 84 | 11.25 | 132 | 10.5 | 124 | 4.5 | 53 | 4.4 | 52 | 2.25 | 26 | 1. | 12 | 7.9 | 93 | | | | | | | | | | |

*General remarks.—Testudo porteri* seems to be still fairly common. It is a very large species with thick, heavy shell. The large males are rounder and more dome-shaped than those of any other locality. Some of the half-grown females can only with great difficulty be distinguished from southern Albemarle specimens. If one may judge from the condition of the bones, the largest specimens in our collection are still quite young, in fact none of our Indefatigable tortoises appears to be of great age. It is probable that they grow rapidly when in their native haunts, although our smallest specimen grew less than an inch and a half in length in six years of life in San Francisco.

Nine eggs (No. 8421) taken from a nest found on Indefatigable October 25, 1905, measure 2.50x2.20, 2.45x2.30, 2.44x2.24, 2.35x2.30, 2.35x2.24, 2.30x2.25, 2.25x2.25, 2.25x 2.20 and 2.23x2.22 inches.

*Field Notes.*—Oct. 25, 1905, went ashore on Indefatigable to look for tortoises at the same place where Beck found them before, and hunted all day. Early in the morning, soon after our arrival at the hunting grounds, we found one small female. We then scattered, everybody following different trails. The trails are from three to five feet wide. At intervals the ground may be seen dug up, like a wallow. No fresh droppings were seen, but lots of old ones along the trails. I saw several apparently fresh wallows, but no tortoises. At two o'clock, we all met at the place we found the first tortoise and started back for the ship, King and Hunter carrying the tortoise. Beck, Williams and myself went a little to the north, and soon fell upon a fresh track. We followed this for about ten minutes, and soon came upon a big male tortoise walking slowly through the brush. While looking at our prize, we heard a noise in the brush at one side, and, turning around, saw a large female heading the way we had just come. We killed the female, and turning the male on his back, tied his feet to a tree, as it was too late to do more. The female had eggs in the ovaries at different stages of development—some already with hard shells and some in yolk. Some vacant spaces were seen from which the eggs had already been laid. We found a nest on one of the trails, and Beck dug it out, finding ten eggs. The nests look like a little round space

scraped clean of brush and leaves. The top is hard earth, but, on digging down the earth gets softer, and a small hole is found about seven or eight inches in diameter, and thirteen inches deep. This is the nest proper and contains the eggs buried in loose soil. Beck found one more set earlier in the day. We brought both sets back to the ship, and shall try to blow them. Shall also try to save those taken from the female captured. Beck found part of the skull of a tortoise he killed when here before. Also saw bones of one he killed on that trip. We are going in tomorrow to try to get out the two other tortoises.

Oct. 26, 1905.—Went in after the tortoises found yesterday. The big male had broken loose from the lashings, but was only about twenty yards away. We started work skinning at once; the mate, Ochsner, King, and myself on the big fellow, with Hunter and Williams on the smaller one. Beck went around looking for more, but failed to find any. However, he reported having seen a fresh trail of a little one, about seven or eight inches wide. At about half past three we started down toward the coast with the tortoises, having removed all the heavy meat from them, and arrived at the vessel at about half past five. The eggs taken from the female were left behind, as we had too much to carry. Tomorrow I suppose we shall clean out the tortoises ready for pickle, and also skin the one brought down yesterday.

Oct. 27, 1905.—Stayed on board all day skinning tortoises. got the two females in pickle, and the big male nearly ready. Beck went inland again, and found two more tortoises—one a fair-sized female and one little tortoise about nine and one-half inches long. King and Williams will go in for the large one tomorrow. I hope tomorrow to get the large male into pickle, and try to blow some eggs.

Oct. 28, 1905.—Went ashore with Williams, and carried out the other tortoise. King finished the large male and blew the eggs. Got embryos out of the eggs from one of the nests. Beck searched all day for tortoises, but failed to find any, or any traces outside of the grounds where we found the others. Will sail tomorrow for South Albemarle.

Nov. 6, 1905.—Beck went ashore with Ochsner, Stewart, and Williams, to cut or find a trail leading into the interior,

and to look for tortoises. Beck found a large female, and killed it. We are going in tomorrow to skin this tortoise. Williams and King will bring it back and Beck and I will camp over night.

Nov. 7, 1905.—Went into the tortoise belt with Beck, prepared to camp for a few days. After hunting all day we found three tortoises, tied them up and returned to camp. One was a large male, and the other two were females. The large male was grazing along in the grass when found, as a cow or a horse might do. It appeared to be perfectly deaf, as it took no notice whatever of us when we went up to it and yelled; but as soon as it saw us it drew in its head with a loud hiss. The tortoise belt is two hundred feet in elevation by barometer, and is filled with cactus and brush together with a number of large trees.

Nov. 8, 1905.—Started out from camp early in the morning. I began skinning a female taken yesterday, while Beck went hunting for more, and made a trail up the mountain. He returned in the evening and we went back to camp.

Nov. 9, 1905.—Started out from camp, and by noon had finished the female I worked on yesterday. Hunter and King came up today and we three started for the coast with the two tortoises. Beck stayed in camp and found another tortoise in the afternoon. He also struck the trail of a large one, which he came up with toward evening. He killed this one, and returned to camp.

Nov. 10, 1905.—Went back to camp again with Ochsner, Hunter and King. Ochsner and King finished skinning a small female, and took it down to the coast. Hunter, Beck and myself went to the big male found yesterday, and partially skinned him so that he could be taken out next day. We returned to the ship by dark.

Nov. 11, 1905.—Stayed on board all day and prepared tortoises. Blew some eggs and straightened things up in general. Beck and the rest of the party went in after the big tortoise. Beck took some pictures of the party carrying the tortoise down a cliff which has to be climbed in order to reach the interior.

Nov. 12, 1905.—All hands resting.

Nov. 13, 1905.—Went in to the camp again, and skinned the large male that we left tied up to a tree. Beck searched for more tortoises and found three farther inland. We returned and camped all night at the old place.

Nov. 14, 1905.—Finished skinning the large male and one female which Beck found yesterday. Hunter and Stewart took out the male, while King and I took out the female. On the way down Williams and Gifford overtook us, and said they had killed a small tortoise up the trail just outside the cactus belt. Williams and I will go after it tomorrow, while the rest help Beck with the other two tortoises.

Nov. 15, 1905.—Went up the trail with Williams after the tortoise found yesterday. He was about half a mile beyond the cactus belt, and when found was crossing the trail, going around the base of the mountain. His stomach contained grass and weeds. Beck, Ochsner, and Stewart brought out the big male, so there is one small tortoise left to carry down.

Nov. 16, 1905.—Stayed on board all day and finished cleaning the tortoises brought down. Have all the tortoises pickled now except some of the Albemarle ones, which are living in the tortoise pen. Expect to sail in the morning for Gordon Rocks and anchor there, so that Mr. Beck and party can try to reach the top of the mountain.

Nov. 17, 1905.—Sailed for Gordon Rocks and anchored about five o'clock in a cove on the northwest side of Indefatigable Island. The country here is a slightly elevated plateau and very open, there being a few cacti and scattered brush.

Jan. 11, 1906.—Were becalmed off the coast southwest of Puerta de l'Aguada, and anchored with the kedge. Beck and Hunter went ashore while I held the boat. Hunter found the skeletons of two small tortoises which appeared to have been killed by natives. No skulls were found.

Jan. 12, 1906.—Spent most of the day watering ship.

Jan. 13, 1906.—Worked on tortoises all day. Beck went ashore and found one large male and a female.

Jan. 14, 1906.—All hands resting.

Jan. 15, 1906.—Beck, King, and myself went into the interior, and skinned and carried out the female tortoise found

Saturday. This tortoise was very fat with large light-colored liver, just the opposite to those found on Duncan. This probably is on account of the difference in food, those on this island getting more green food, while the Duncan tortoises get dry grass and lichen also. We are going in to-morrow for the large male. The female had very few eggs in the ovaries, all in yolk form.

Jan. 16, 1906.—King, Beck, and myself went into the interior and brought out the big tortoise found on Saturday, the 13th. This tortoise had more fat than any other male taken thus far. As a rule they do not have nearly so much as the females.

Jan. 17, 1906.—King, Beck, and myself went in again after tortoises. Found three, but one got away. Skinned a small female, and brought her down to the ship. We are going in after another female that is tied up. King found the big male that got away.

Jan. 18, 1906.—Went in again after tortoises, and skinned and carried out a male tortoise found yesterday. Beck found another female today, and also the big male that got away. We now have two females and a large male tied up, and are going in tomorrow with all hands to get the two females. The tortoise skinned today was found eating cactus, and its stomach was full. The bladder was full of water. Lots of cactus spines were stuck in the throat. All the tortoises taken during this visit here were found about three and one-half miles inland.

Jan. 19, 1906.—Went in after the two female tortoises which had been left tied up. We find the females have much larger livers than the males. One of the tortoises taken today is about the largest female we have found.

Jan. 20, 1906.—Went in and brought out the tortoise which escaped from us on the 17th. He had traveled about two miles in an afternoon. He was fairly fat for a male, and had a stub tail, probably due to some accident when small.

July 11, 1906.—Sailed for Puerta de l'Aguada and anchored at eleven in the morning.

July 12, 1906.—Went in after a tortoise with King and Beck. In the same country where we had hunted before we found numerous trails and signs of tortoises. We ran across

a good-sized male early in the morning, and skinned and brought him out. His stomach contained cactus.

July 20, 1906.—At anchor at a little cove near Conway Bay where the trail that led up to the old settlement commenced.

July 24, 1906.—Went ashore for a couple of hours in the morning and got a mess of doves for food. The country here is covered with dry grass and small trees. I saw no reptiles of any description. We sailed for Daphne Island at about nine o'clock.

### Testudo species?

Cowley Mountain Tortoise.

Plates 122 and 123.

*Distribution.*—Cowley Mountain, Albemarle Island, Galapagos Archipelago.

*Material.*—The Academy collection includes only one skin with bones of a female, and a few fragments of other individuals.

*Diagnosis.*—No nuchal; gulars paired; fourth cervical vertebra biconvex; front of carapace low; height at nuchal notch 36% of straight length; difference between percentages of front and middle heights 25; carapace dome-shaped, broad anteriorly, width at margin of junction of second and third marginals 54%; first marginals not greatly enlarged, not everted; their ventral surfaces not vertical, their most prominent points separated by less than 25% (17%); length over curve more than 123% (128%); width over curve greater than length over curve; vertical distance from lower surface of plastron to lower edge of lateral marginals great, 10%; general size moderate, straight length 26.75 inches; plastron moderately long, 85%; plates striated; pectorals forming a suture on median line; eighth marginal plate not reduced; lower jaw and throat of female black.

TABLE OF MEASUREMENTS OF COWLEY MOUNTAIN TORTOISE.

| Number | Sex | Straight | | | Curved | | | Width 2d to 3d marginals | | Height | | | | Height to marginals | | Plastron | | Fore Limb | | Hind Limb | | Axilla to Elbow | | Neck | Tail | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Length | Width | Per Cent | Length | Per Cent | Width | Per Cent | | Middle | Per Cent | Front | Per Cent | | | | | | | | | | | | | |
| 8141 | ♀ | 26.75 | 22.5 | 84 | 34.5 | 128 | 37. | 138 | 14.4 | 16.25 | 61 | 9.5 | 36 | 2.7 | 10 | 22.9 | 85 | 12.8 | 48 | 13.2 | 49 | 7.2 | 27 | | 2.4 | 9 |

*General remarks.*—This tortoise is most closely related to *T. porteri* of Indefatigable Island and *T. vicina* of the southern part of Albemarle Island. It is more nearly circular in outline than any other tortoise. Its high dome-shaped back makes it resemble *T. porteri* very closely, but it is more like the dome-shaped females of *T. vicina* in its curved length, and in its width at second and third marginal suture. The difference between the front and middle heights is greater than in any specimen of *T. vicina.* The width at suture between second and third marginals is less than in most of my specimens of *T. porteri;* as is also the curved length. The female taken had well developed ovaries containing large yolks. With only a single female specimen of this tortoise for comparison, it is quite impossible to be certain as to whether it really represents a distinct race. It, therefore, seems best to leave it without a specific name until male specimens have been secured.

*Field Notes.*—Aug. 9, 1906.—Sailed from James Bay for Cowley Mountain, Albemarle, and anchored off the mountain at about six in the evening.

Aug. 10-11, 1906.—Went in after tortoises. Cowley Mountain on this eastern side is a vast stretch of pumice stone with practically no vegetation for some miles inland. It rises with a gradual slope for about five miles, then gets quite steep at the elevation of about two thousand feet, where the vegetation becomes thick—small trees covered with moss, and tall dry grass tramped down in most places by the mules, being met with. At about 2200-2500 feet, a level area about a mile and a half in width surrounds the rim of the volcano. The mules do not get into this area because of a tall grass, growing higher than one's head, which it is almost impossible to push through. We had a good look at the rim of the crater but could not get through to it, so, turning back, we camped for the night near the edge of this belt. We searched for tortoises next morning in the dry grass below, and found signs about a month old, but did not see any tortoises. The trails ran into the mule trails, which made it impossible to track them. Beck came down the mountain where we were looking, and ran across a tortoise a little farther up the hill. He had been over to the southward, and found it a little better going, so that he got closer to the crater. He found the camp where the natives

killed the tortoises, and saw about seventy old skeletons. We saw a few to the northward. It is a capital place to use mules, and, no doubt, the natives cleaned the tortoises out very thoroughly here. Beck skinned the tortoise out roughly, and King and I finished it on Sunday.

### Testudo species?

Barrington Island Tortoise.

Plates 123 and 124.

Nothing has been known of the presence of tortoises on Barrington Island. None of the early navigators mentions having seen them there, and no recent visitor to the archipelago has made note of them. Our expedition secured evidence that tortoises formerly were fairly abundant on this island. Fragmentary remains of some fourteen individuals were found. These are mostly very old bones—pelves, femora, humeri, etc.—and leave us completely ignorant of the shape and relationship of the tortoises of Barrington Island. A few of these bones are figured in the plate given. Two very old semi-fossil eggs also were found, one of which is shown, photographed together with eggs from Albemarle, Duncan, and Indefatigable islands, in Plate 124. These eggs are larger than any that I have seen from other islands. They (No. 8424) measure 2.55x2.25 and 2.50x2.40 inches. Some of the bones evidently came from very large tortoises, while some with well-united sutures are quite small. It would thus appear that the tortoises of Barrington Island varied considerably in size.

*Field Notes.*—Feb. 22, 1906.—We met the schooner from Guayaquil, and saw the Captain, who is an Englishman. He says he has taken tortoises on Chatham, and says he ate the last one on the island some twenty years ago. He also reports having taken them off Barrington Island about fifteen years ago, but that they are now extinct. None of our party saw any remains while staying there. He got tortoises from Hood some years ago, probably before 1897. There was an Albemarle tortoise tied up at the wharf, and the Captain says the tortoise changes his shell completely, but he doesn't know how often! This one had a plate on the carapace loose.

July 9, 1906.—Sailed for Barrington Island about 5 A. M. and arrived at 11 A. M. Captain Levick, of the schooner that runs between the islands, informed us that thirty years ago tortoises were found scattered all over Barrington, and that he had taken them off that island. He doubted very much whether we would find any as, he says, they were all killed off long ago. We landed after dinner and proceeded on a tortoise hunt. For lack of time, we could not go far or cover much ground, but we had good luck. Beck found some old bones, and Mr. Nelson, the mate, found two old eggs on the north side of the island. He said they were near an iguana's hole, whence they had been dug out and were lying on the ground. They appear to be not more than a year old. We are going in again tomorrow. Mr. Nelson says he will try to find the spot again where he took the eggs, and we will dig down and see if any more can be found. He was in too much of a hurry to look, as it was nearly dark and he was heading for the boat at full speed.

July 10, 1906.—Made another search for tortoises, but found no live ones. Beck found some more bones on the higher portions of the north end of the island. He mentions having seen a very old piece of dung yesterday. Mr. Nelson tried to find the place where he found the old eggs, but failed to do so. We have come to the conclusion that the eggs probably are more than a year old, and were lately dug up by iguanas and exposed to the sun. King and I visited the valleys on the north coast, but found no signs whatever of tortoises.

## GENERAL CONCLUSIONS.

The various races of tortoises of the Galapagos Islands differ from one another chiefly in shape. There are no real differences in structure, such as are found in the lizards and snakes of the archipelago. The relative values which should be attached to these differences in shape are extremely difficult to estimate. Therefore the tortoises do not throw much light upon the history and development of the archipelago. Some points, however, are of considerable interest.

Tortoises either live, or are known to have lived, upon Abingdon, Chatham, Hood, Charles, Barrington, Indefatiga-

ble, James, Jervis, Duncan, Narborough, and Albemarle islands. The last named island supports several races of tortoises. The tortoises of Barrington are practically unknown. Each of the other nine islands had its own peculiar race of tortoise, and on none of these nine islands has evidence of more than one race been found. This lends particular interest to the fact that several races of tortoises occur on Albemarle Island.

Although these tortoises can live for at least several days floating on the surface of the ocean, they are absolutely helpless in the water. They are unable to swim, and can only float and drift at the mercy of the winds and currents. When they drift on island shores, they usually are so battered and injured on the rocks that they only live a few days thereafter. The fact that each island, except Albemarle, has one and only one race of tortoise, is evidence that interchange of tortoises between the islands has not occurred, for such interchange would result either in preventing differentiation or in the presence of more than one race on an island.

If the transportation of tortoises from one island to another does not occur, there is little reason to believe that tortoises, at some time in the past, have drifted over the vastly greater distance from some continent, and have reached each of the eleven islands on which they have been found. Nor do we know whence they could have come. The evidence offered by these tortoises, therefore, seems to be against the view that these are oceanic islands, which have been independently thrust above the surface of the water, and have received such animals as have drifted to them. We must rather adopt the view that the islands are but the remains of a larger landmass which formerly occupied this region, and was inhabited by tortoises, probably of but one race; that the gradual partial submersion of this land separated its higher portions into various islands; and that the resulting isolation of the tortoises upon these islands has permitted their differentiation into distinct races or species.

If isolation plays so prominent a part in the differentiation of species in the Galapagos Archipelago, and each island has its one distinct race, what is the explanation of the fact that on Albemarle Island five distinct races of tortoises occur?

September 30, 1914.

The fact that each of the five great mountains of Albemarle seems to have been the original home of one of these five races, suggests that these volcanoes formerly were separated by water and formed five islands. These five islands must have remained separate long enough to permit the development of the differences which distinguish the five kinds of tortoises now found upon Albemarle. Then these five small islands must have been elevated until they merged to form the present Albemarle Island.

If there has been such an elevation of Albemarle Island in recent times, we might hope to find some record of it in the rocks, either in the form of fossils or of elevated beaches. Mr. Ochsner, the geologist of our expedition, found such evidence; but, since his results have not yet been published, I shall content myself by calling attention merely to Heller's statement:

"Near Iguana Cove, Albemarle, there are several old sea-cliffs now situated a considerable distance inland. At Tagus Cove on the same island a series of terraces, still containing the characteristic cavities made by sea-urchins, are now several hundred feet above the present sea-level."

This is positive proof of the recent elevation of Albemarle Island, and favors our explanation of the presence of several species of tortoises upon this island.

Our studies of the reptiles of the Galapagos Archipelago, therefore, all point to the conclusion that these are not oceanic islands. We must regard the present islands as made up of the higher portions of a much more extensive land-mass which formerly existed in this region. This Galapagos Land was the home, probably, of one race of giant tortoises, of one kind of gecko, of one species of *Tropidurus,* of two kinds of iguanas, and of two species of snakes. Gradual depression resulted in the submersion of much of this Galapagos Land. As the lower portions were covered by water the higher parts became, at intervals, separate islands, inhabited, after isolation, by the same kinds of reptiles which had occupied them before. Variation through a long period of time produced specific and sub-specific changes in these isolated colonies of reptiles, until each island upon which tortoises remained sustained its own peculiar kind. Similarly, the snakes, the gecko, and the *Tropidurus,* of various islands became differentiated. Since

this differentiation varies in degree on the various islands—being greatest usually on the more out-lying islands—it may be regarded as an index to the order of separation of the various islands, and evidence of their gradual depression. Only on Albemarle Island do the reptiles suggest that there has been land elevation, and even here the recent period of rising must have been preceded by a long period of depression, during which the present Albemarle Island was represented, probably, by five separate islands corresponding to its five great volcanoes.

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# INDEX

(Synonyms in *italics;* new names in **black face type.**)


Abingdon Island Tortoise, 296
abingdoni, Testudo, 296
abingdonii, Testudo, 296
Adams, C. F., 228
Agassiz, Professor A., 228
Professor Louis, 226
Atahualpa, 209
Barrington Island Tortoise, 365
Baur, Dr. George, 210
Beck, R. H., 242
becki, Testudo, 303
*bedsi, Testudo,* 303
Berlanga, Fray Tomas de, 209
Bibliography, 369
Bibron, M., 223
Brown, Dr. Arthur E., 247
Bynoe, Mr., 222, 225
*californiana, Testudo,* 245, 316
Charles Island Tortoise, 316
Charts showing variation, 289
chathamensis, Testudo, 323
Chatham Island Tortoise, 323
Clipperton, 211
Cochrane, Rear Admiral, 226
Colnett, Captain James, 212
Conclusions, General, 366
Contents, 203
Cooke, 210
Cookson, Commander, 226, 228
Cowley, 210
Cowley Mountain Tortoise, 362
Dampier, 210
Darwin, Charles, 220, 235
darwini, Testudo, 319
Davis, Edward, 210
de Beauchesne, Captain, 211
de Freycinet, M., 244, 316
de Jeude, Van Lidth, 291
Delano, Amasa, 212
Description, 259
Descriptions of the Races, 295
Downes, Commodore John, 220, 255
Drowne, F. P., 228, 229
Duméril and Bibron, 249
Duncan Island Tortoise, 306
*elephantina, Testudo,* 354
elephantopus, Testudo, 245, 316
ephippium, Testudo, 251, 306
Evans, Whitton, 245, 246
Expedition to the Galapagos Islands, 203
Fitzroy, Admiral, 228
Fray Tomas de Berlanga, 209
Gadow, Hans, 257
**gadowi,** Testudo, 257
*galapagoensis, Testudo,* 255, 316
Galapagos Archipelago, Gigantic Land Tortoises of the, 203
Galapagos Islands, Expedition to the, 203
General Conclusion, 366
Gifford, E. W., 242
Gigantic Land Tortoises of the Galapagos Archipelago, 203
Gray, M., 223
Günther, Dr. Albert, 245, 249, 251, 252
güntheri, Testudo, 256, 335
Habel, Dr., 226
Hall, Captain Basil, 219, 251
Harlan, Dr. Richard, 245
Harris, 210
Harris, C. M., 228
Heller, Edmund, 234
Hernandez, Colonel, 220
hoodensis, Testudo, 313
Hood Island Tortoise, 313
Hull, G. D., 228
Hunter, J. S., 242
Indefatigable Island Tortoise, 354
*indica, Testudo,* 316, 354
Iguana Cove Tortoise, 344
Introduction, 206
Jackson, Dr. J. B., 255
Jahnke, Herman, 231
James Island Tortoise, 319
Jervis Island Tortoise, 351
Key to Galapagoan Races, 293
Kinberg, Dr., 226
King, E. S., 242
Knight, 210
Land Tortoises of the Galapagos Archipelago, Gigantic, 203
Lawson, Mr., 222, 223
Levick, Captain, 366
Linbridge, Captain, 228
Measurements of Abingdon Island Tortoises, 297
Measurements of Bank's Bay Tortoises, 304
Measurements of Cape Rose Tortoises, 331
Measurements of Chatham Island Tortoises, 324
Measurements of Cowley Mountain Tortoise, 363
Measurements of Duncan Island Tortoise, 307, 308, 309
Measurements of Hood Island Tortoises, 314
Measurements of Iguana Cove Tortoises, 345
Measurements of Indefatigable Island Tortoises, 356
Measurements of James Island Tortoises, 320
Measurements of Jervis Island Tortoise, 352

# INDEX


Measurements of Narborough Island Tortoises, 300
Measurements of Old Cobos Settlement Tortoises, 345
Measurements of South Albemarle Tortoises, 337, 346, 347
Measurements of Tagus Cove Tortoises, 330
Measurements of Vilamil Tortoises, 336
Meek, Captain, 244, 316
microphyes, Testudo, 252, 329
Morrell, Captain Benjamin, 219
Narborough Island Tortoise, 299
Nelson, Mr., 366
*nigra, Testudo,* 244, 316
*nigrita, Testudo,* 249
Nomenclature, 244
North Albemarle Island Tortoise, 303
Noyes, Captain, 237
Ochsner, W. H., 242
Osteological differences, 292
phantastica, Testudo, 299
*planiceps, Testudo,* 251, 354
Plates, 373
Porter, Captain, 215
porteri, Testudo, 354
Quoy and Gaimard, 244
Rogers, Woodes, 211
Rothschild, Walter, 228, 313
Seemann, B., 226
Slevin, J. R., 242
Snodgrass, Robert E., 234
Stewart, Alban, 242
Stone, Witmer, 247
Systematic Account, 244
Table of Measurements of Tortoises, 287, 288
Tagus Cove Tortoise, 329
Testudo abingdoni, 296
becki, 303
*bedsi,* 303
*californiana,* 245, 316
chathamensis, 323
darwini, 319
*elephantina,* 354
elephantopus, 245, 316
ephippium, 251, 306
gadowi, 257
*galapagoensis,* 255, 316
güntheri, 256, 335
hoodensis, 313
*indica,* 316, 354
microphyes, 252, 329
*nigra,* 244, 316
*nigrita,* 249
phantastica, 299
*planiceps,* 251, 354
porteri, 354
species ?, 362, 365
vicina, 253, 344
wallacei, 257, 351
Tortoises of the Galapagos Archipelago, Gigantic Land, 203
Traquair, Dr., 251, 252
Tupac Yupangi, 209
Vancouver, 211
Van Denburgh, John, 203
Variation with age, 289
distribution, 290
individual, 291
sex, 289
vicina, Testudo, 253, 344
Vilamil, J., 219, 220
Vilamil Mountain Tortoise, 335
Wafer, 210
wallacei, Testudo, 257, 351
Watkins, Patrick, 219
Webster, Frank B., 228, 237
Williams F. X., 242
Wood and Rogers, 226

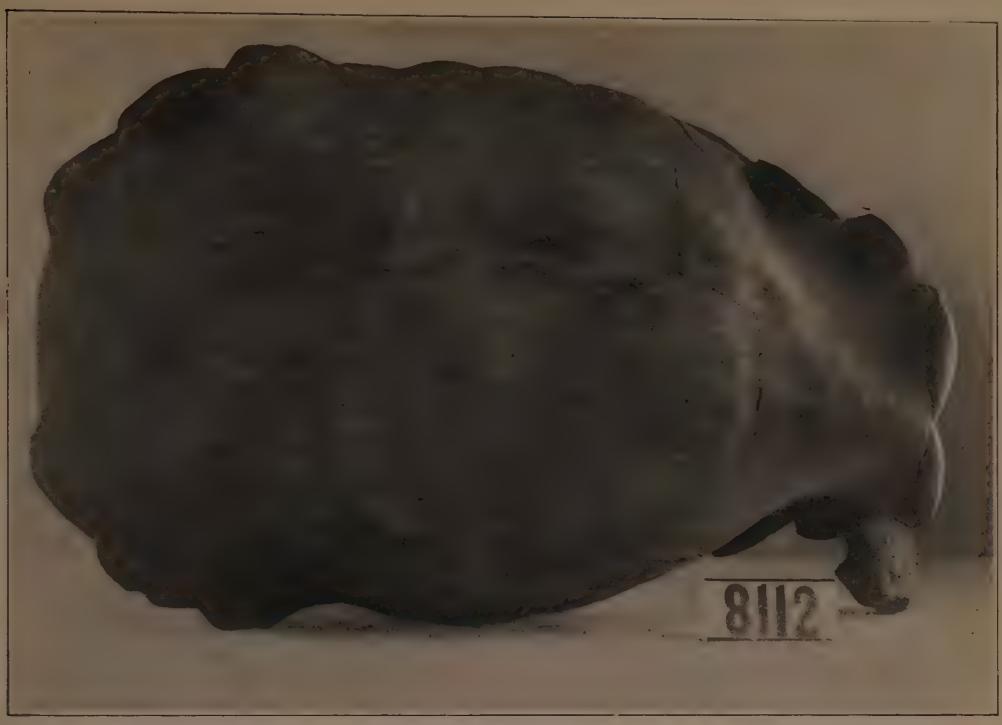


Fig. 1. Testudo abingdoni Günther.
Abingdon Island. 36 inch male. From above.

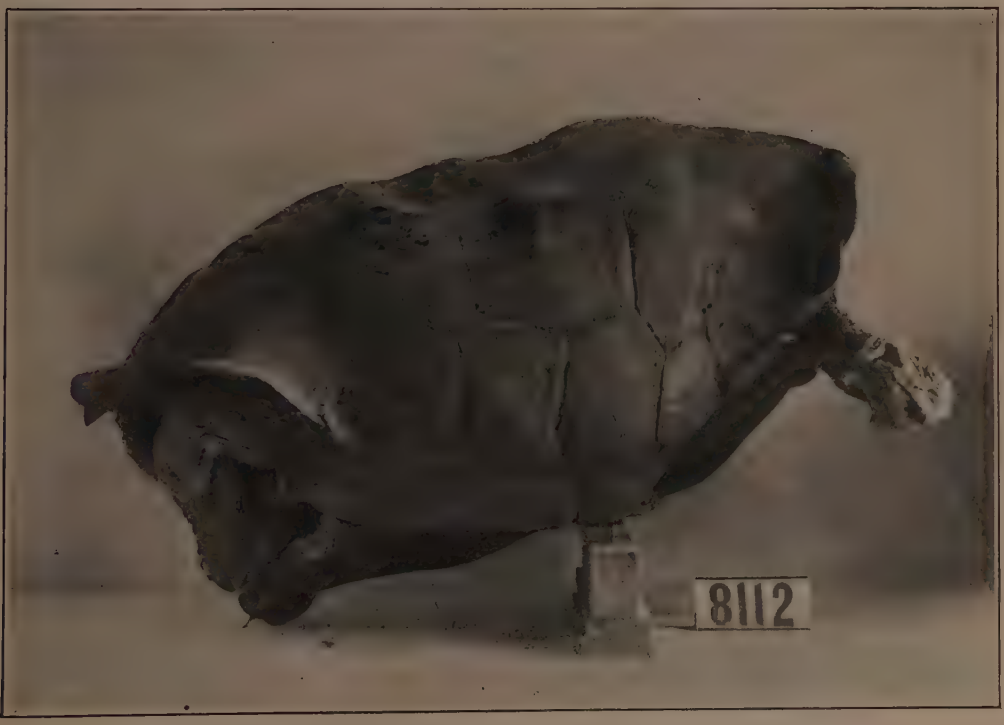


Fig. 2. Testudo abingdoni Günther.
Abingdon Island. 36 inch male. From side.

Fig. 1. Testudo abingdoni Günther.
Abingdon Island. 36 inch male. From in front.

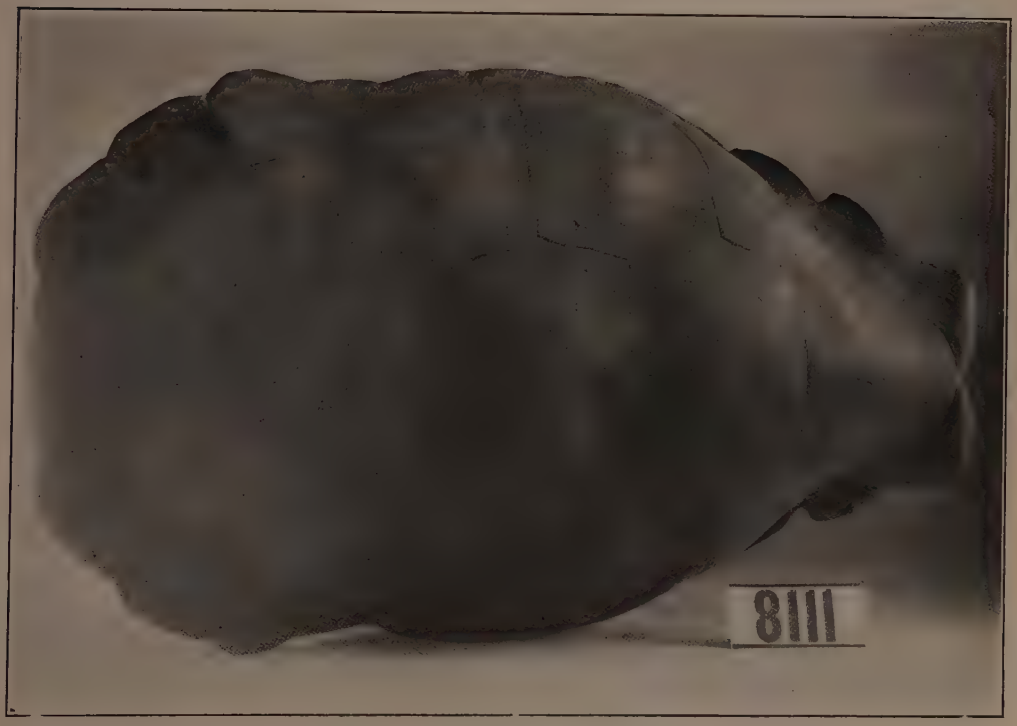


Fig. 2. Testudo abingdoni Günther.
Abingdon Island. 35 inch male. From above.

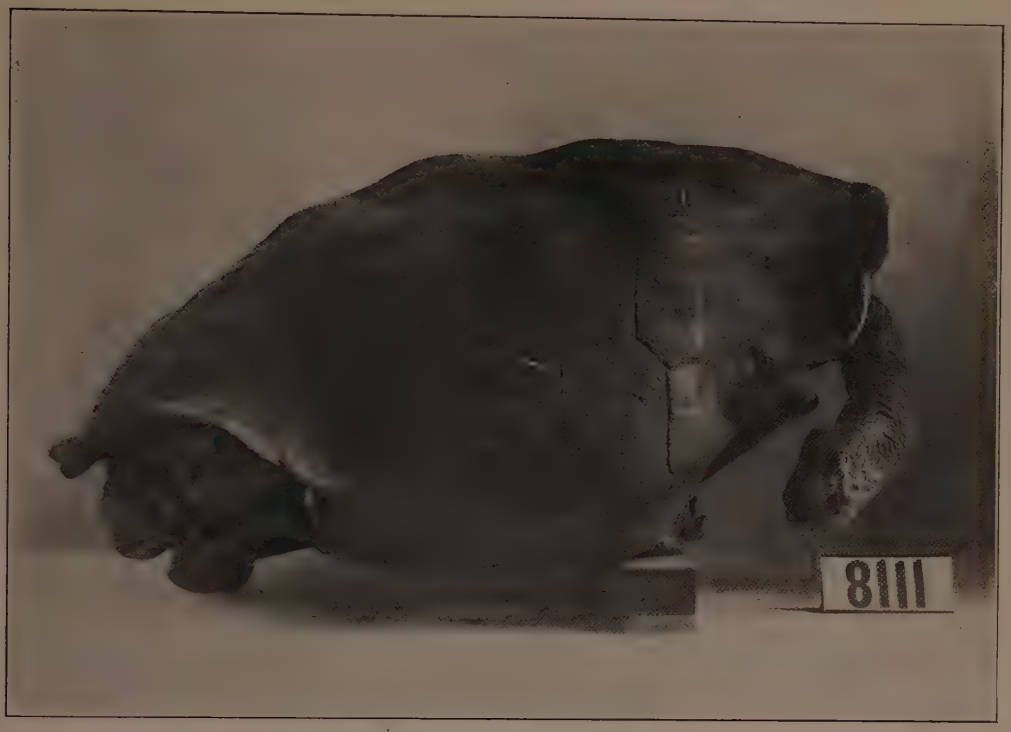


Fig. 1. Testudo abingdoni Günther.
Abingdon Island. 35 inch male. From side.

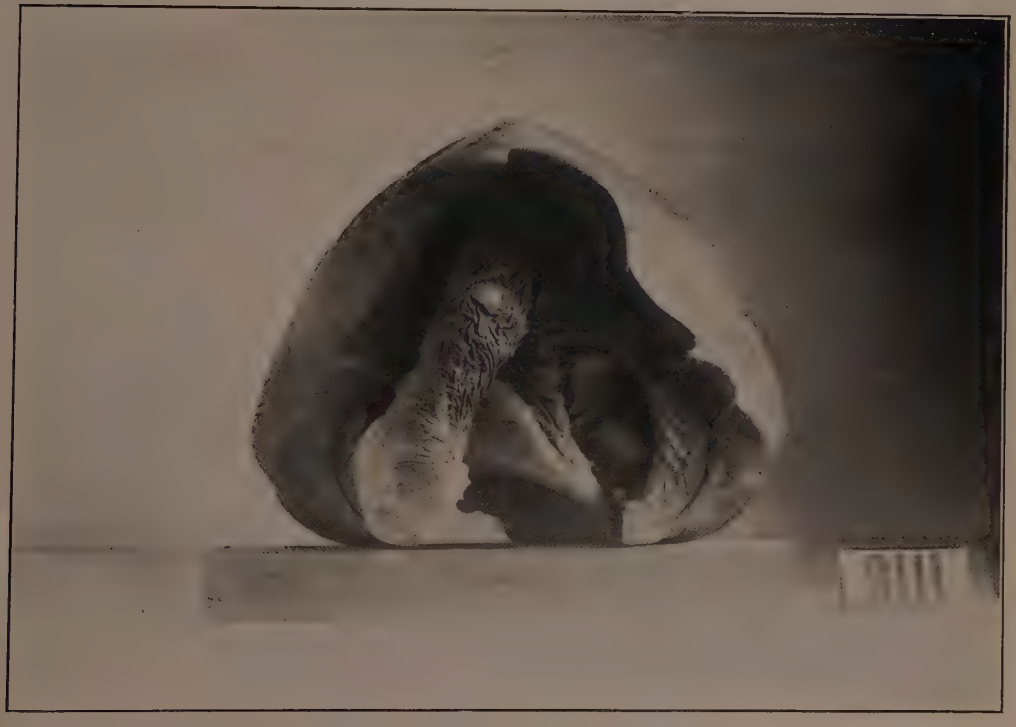

Fig. 2. Testudo abingdoni Günther.
Abingdon Island. 35 inch male. From in front.

Fig. 1. Testudo abingdoni Günther.
Abingdon Island. 32 inch male. From side.

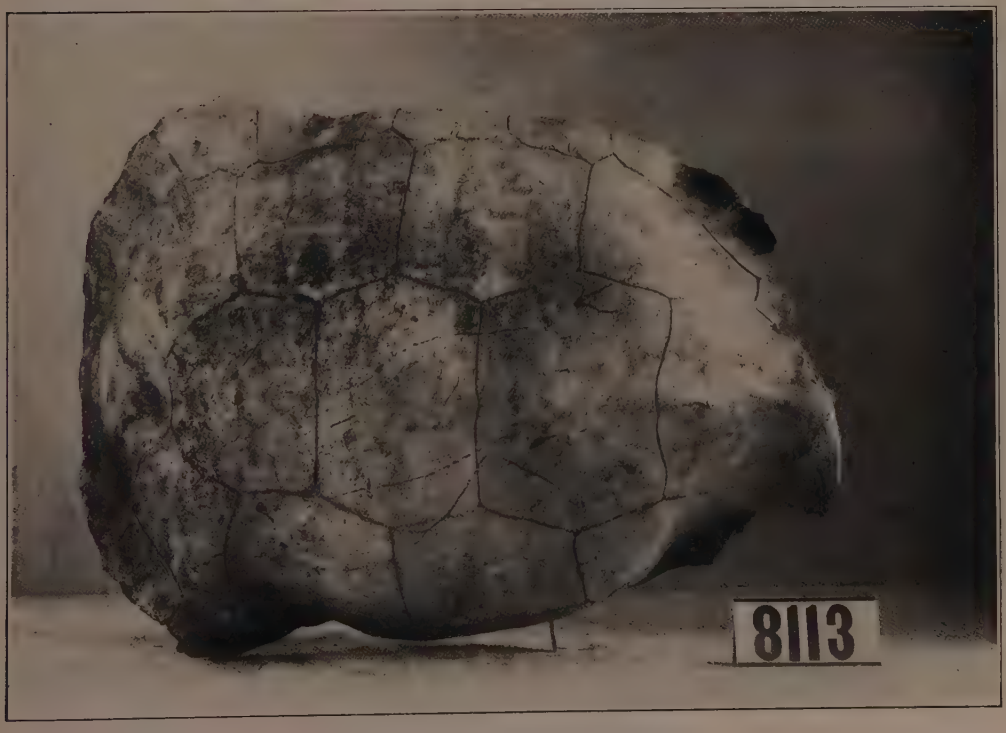


Fig. 2. Testudo abingdoni Günther.
Abingdon Island. 29.3 inch bony carapace. From above.

Fig. 1. Testudo abingdoni Günther.
Abingdon Island. 29.3 inch bony carapace. From side.

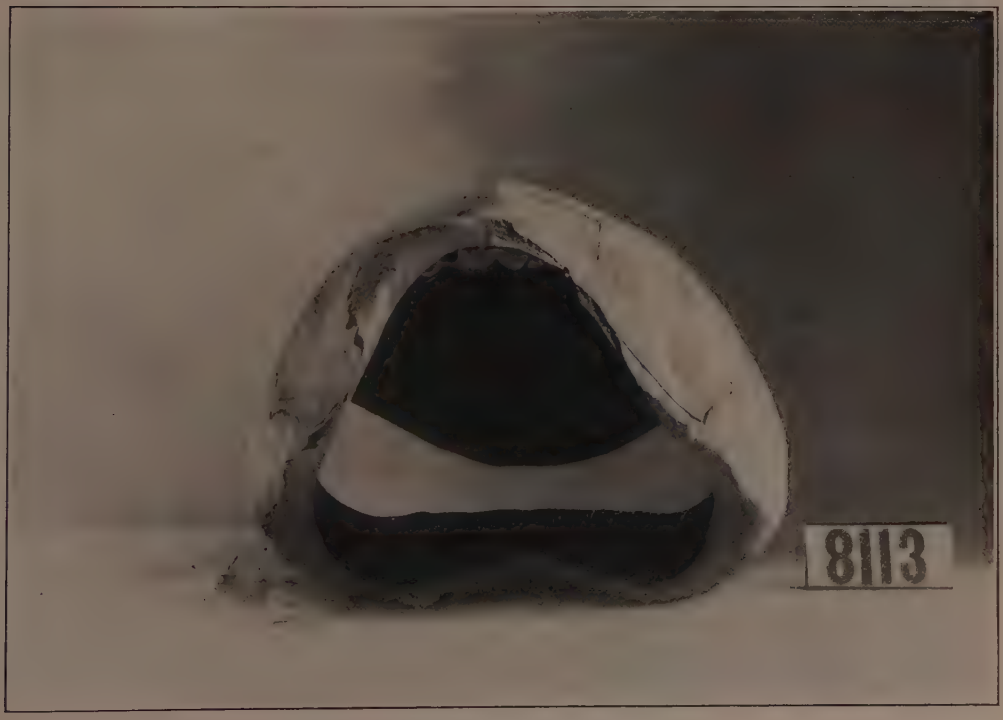


Fig. 2. Testudo abingdoni Günther.
Abingdon Island. 29.3 inch bony carapace. From in front.

Fig. 1. Testudo abingdoni Günther.
Abingdon Island. 29.3 inch bony carapace. from below.

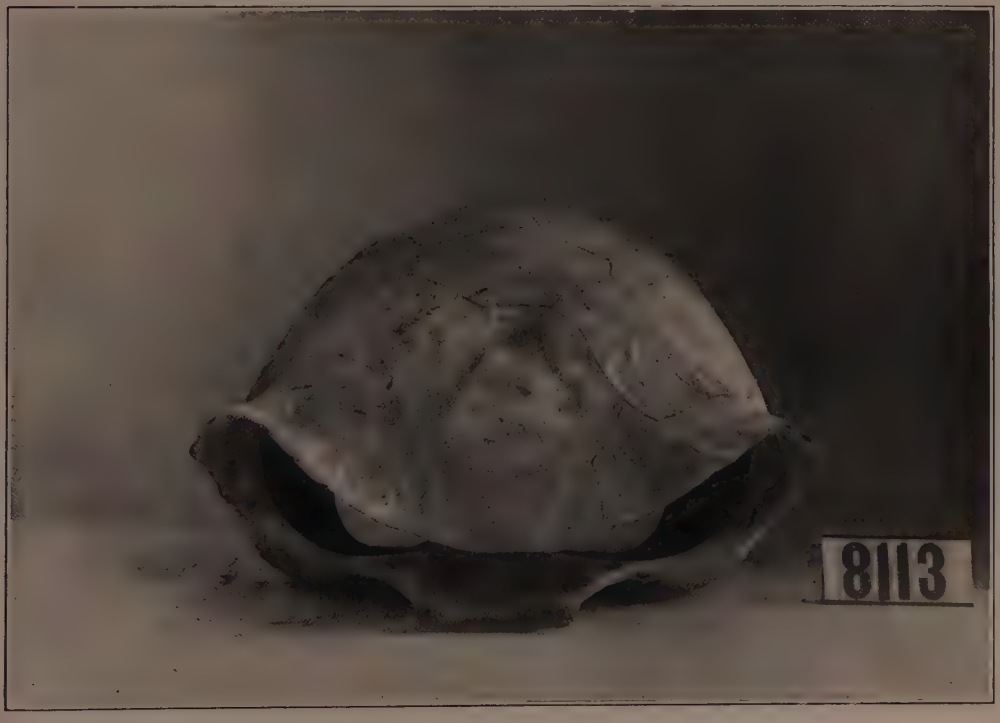


Fig. 2. Testudo abingdoni Günther.
Abingdon Island. 29.3 inch bony carapace. From behind.

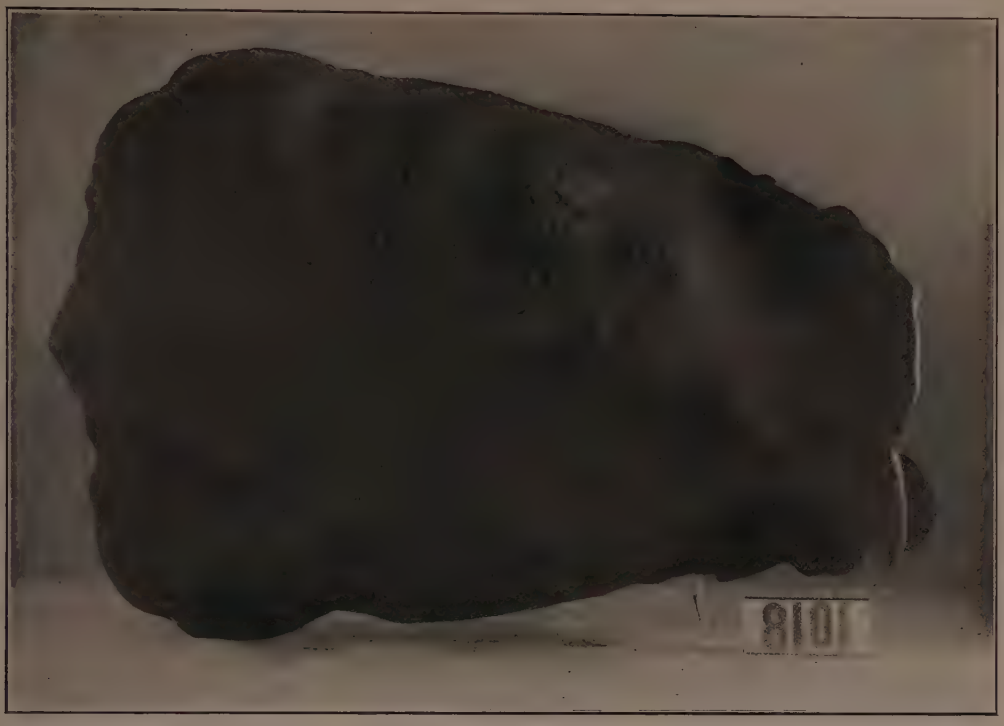


Fig. 1. Testudo phantastica Van Denburgh.
Narborough Island. 34.5 inch male. From above.

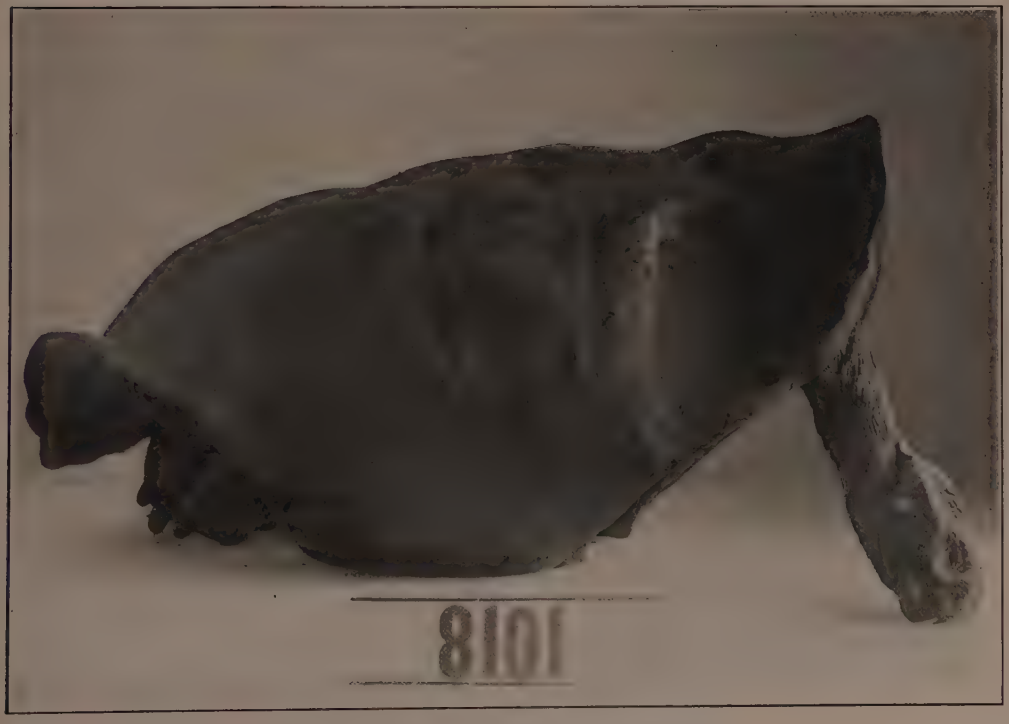


Fig. 2. Testudo phantastica Van Denburgh.
Narborough Island. 34.5 inch male. From side.

Fig. 1. Testudo phantastica Van Denburgh.
Narborough Island. 34.5 inch male. From in front.

Fig. 2. Testudo becki Rothschild.
Bank's Bay, Albemarle Island. 37.3 inch male. From above.

Fig. 1. Testudo becki Rothschild.
Bank's Bay, Albemarle Island. 37.3 inch male. From side.

Fig. 2. Testudo becki Rothschild.
Bank's Bay, Albemarle Island. 37.3 inch male. From in front.

Fig. 1. Testudo becki Rothschild.
Bank's Bay, Albemarle Island. 34.25 inch male. From above.

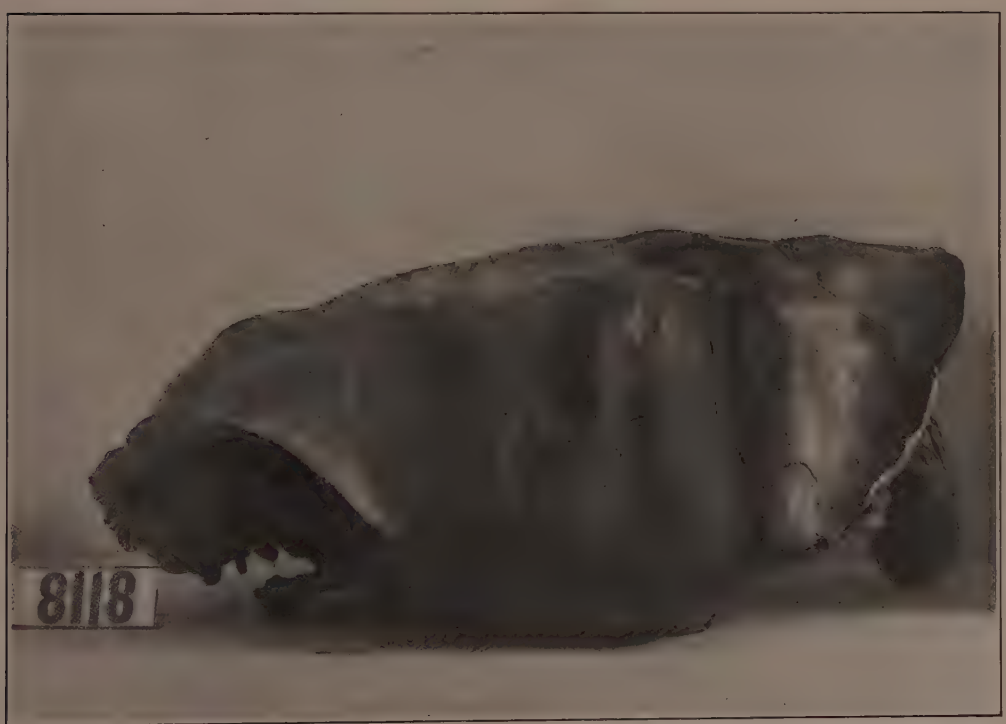


Fig. 2. Testudo becki Rothschild.
Bank's Bay, Albemarle Island. 34.25 inch male. From side.

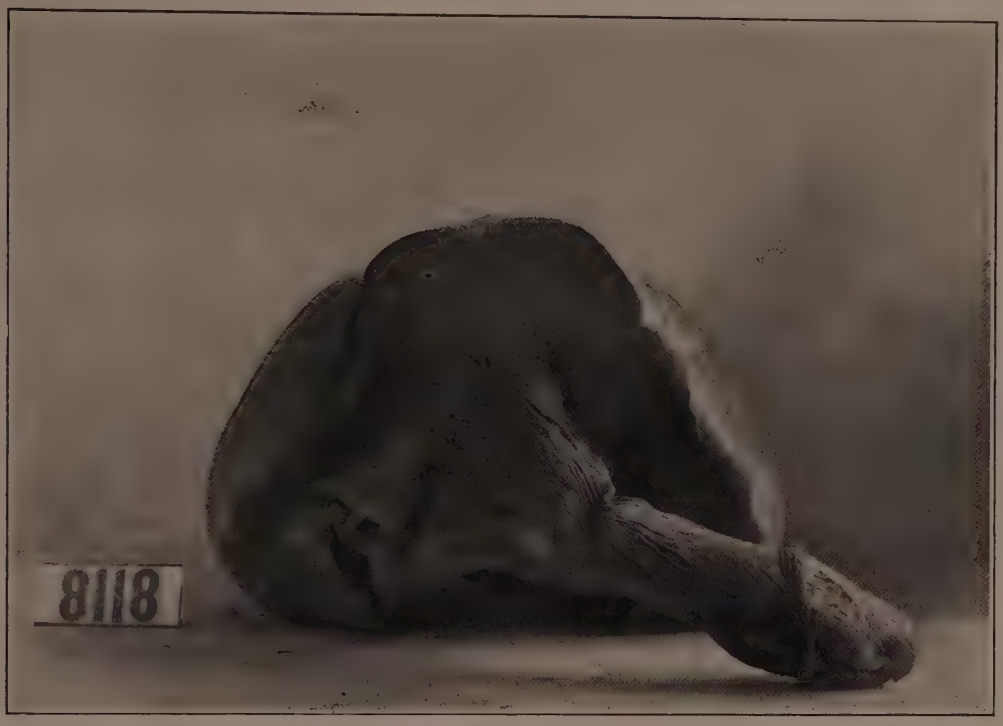


Fig. 1. Testudo becki Rothschild.
Bank's Bay, Albemarle Island. 34.25 inch male. From in front.

Fig. 2. Testudo becki Rothschild.
Bank's Bay, Albemarle Island. 34 inch male. From above.

Fig. 1. Testudo becki Rothschild.
Bank's Bay, Albemarle Island. 34 inch male. From side.

Fig. 2. Testudo becki Rothschild.
Bank's Bay, Albemarle Island. 34 inch male. From in front.

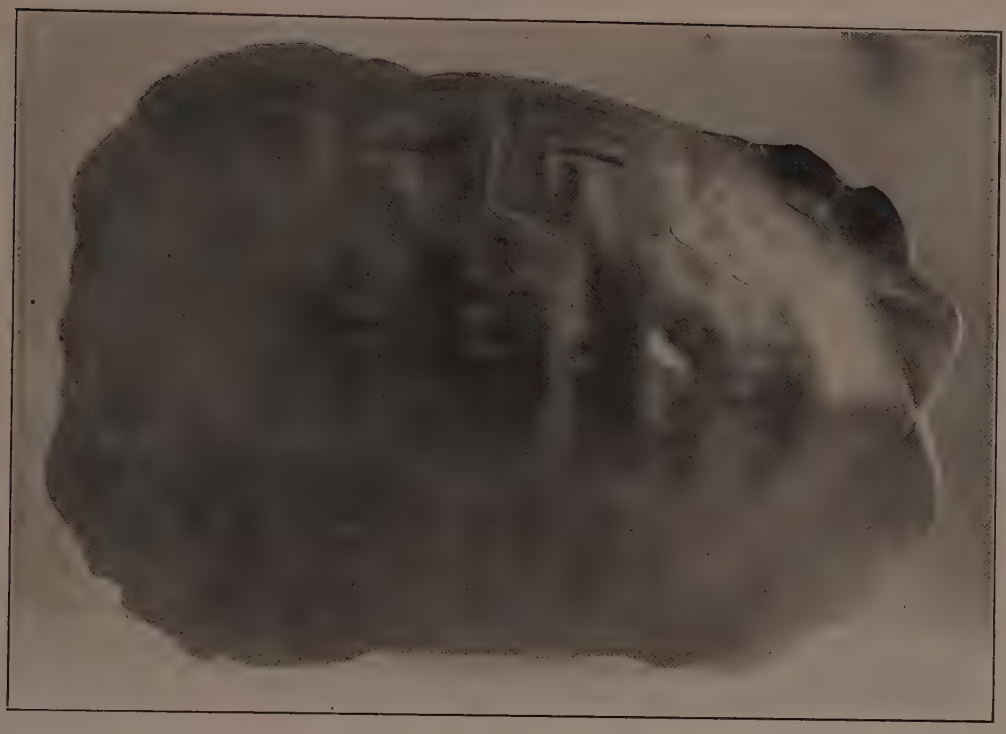

Fig. 1. Testudo becki Rothschild.
Bank's Bay, Albemarle Island. 41.5 inch male. From above.

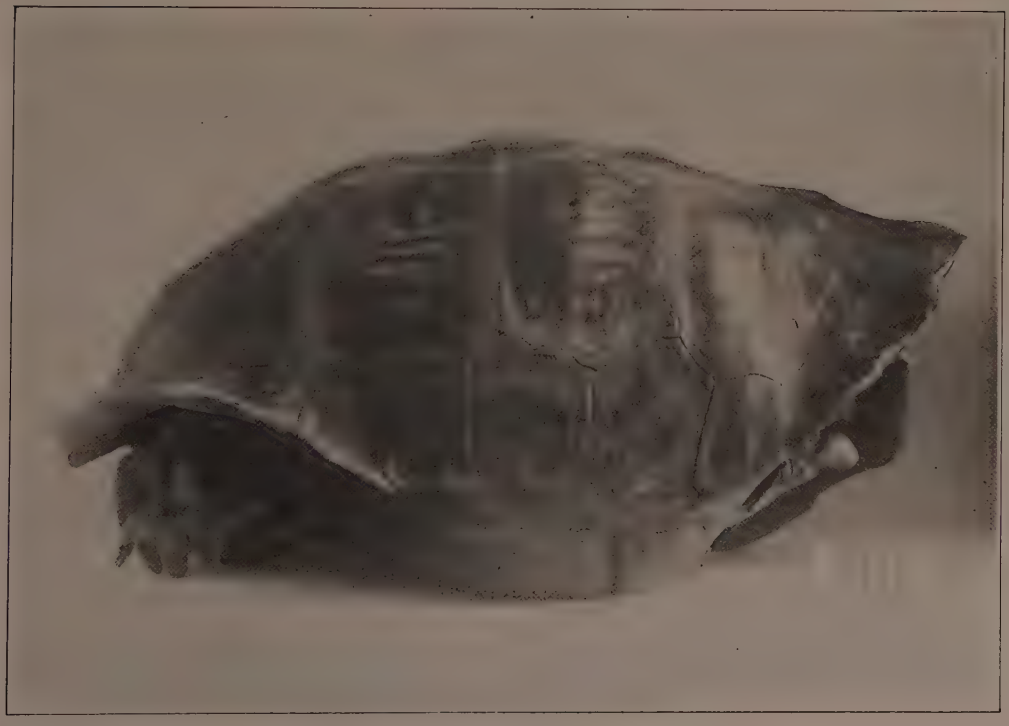

Fig. 2. Testudo becki Rothschild.
Bank's Bay, Albemarle Island. 41.5 inch male. From side.

Fig. 1. Testudo becki Rothschild.
Bank's Bay, Albemarle Island, 41.5 inch male. From in front.

Fig. 2. Testudo becki Rothschild.
Bank's Bay, Albemarle Island. 21.75 inch adult female. From above.

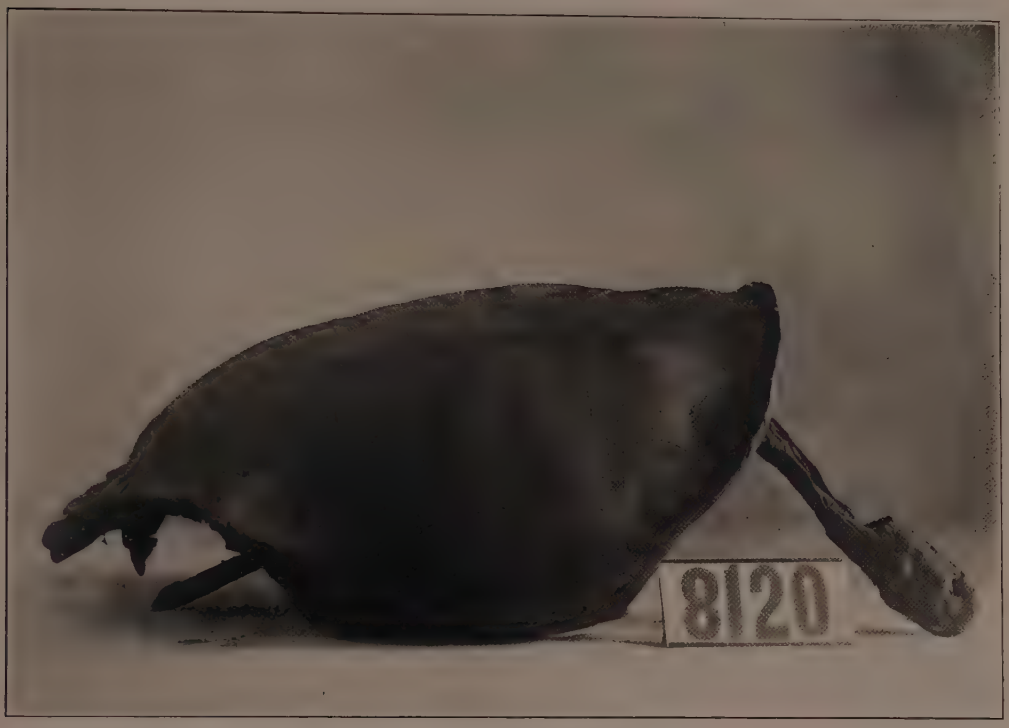


Fig. 1. Testudo becki Rothschild.
Bank's Bay, Albemarle Island. 21.75 inch adult female. From side.

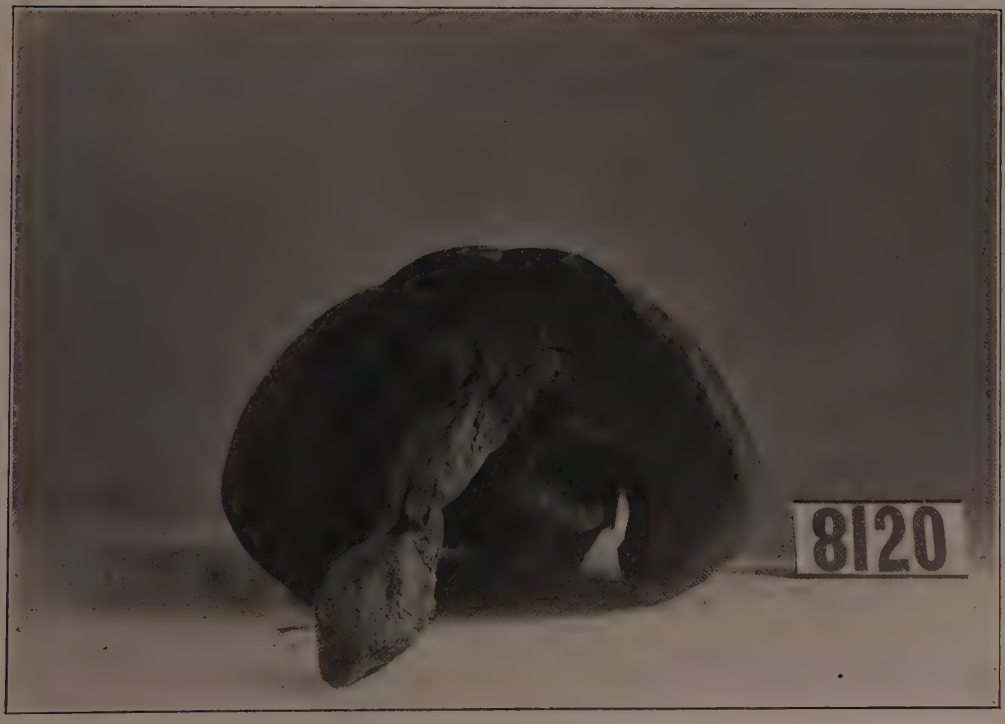


Fig. 2. Testudo becki Rothschild.
Bank's Bay, Albemarle Island. 21.75 inch adult female. From in front.

Fig. 1. Testudo ephippium Günther.
Duncan Island. 29.5 inch male. From above.

Fig. 2. Testudo ephippium Günther.
Duncan Island. 29.5 inch male. From side.

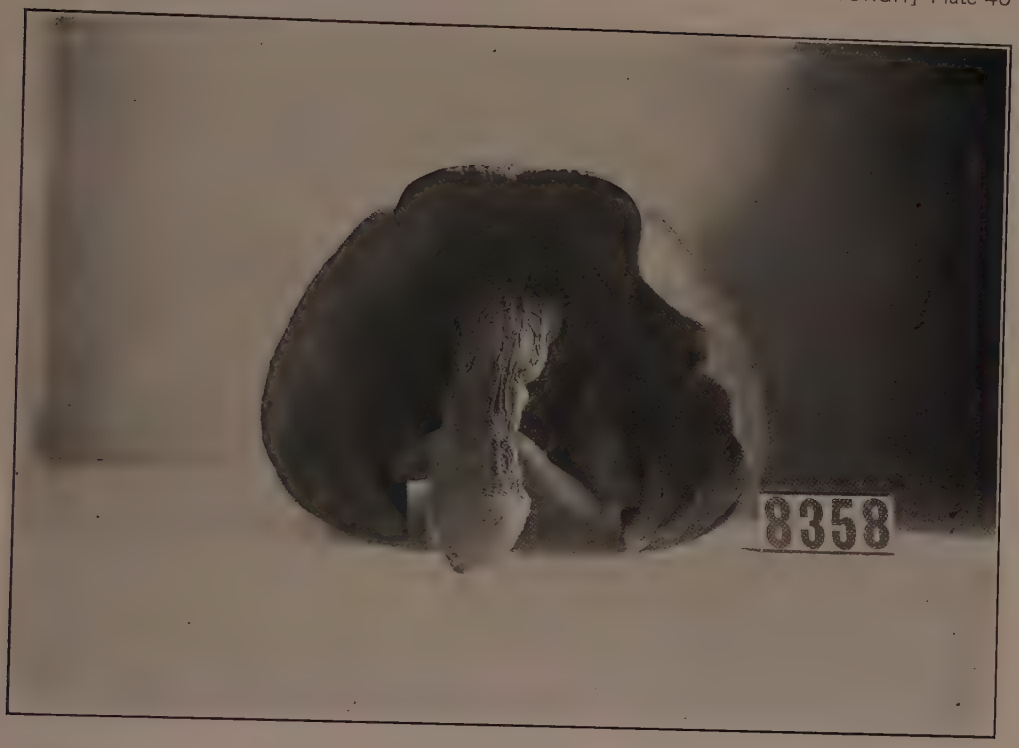


Fig. 1. Testudo ephippium Günther.
Duncan Island. 29.5 inch male. From in front.

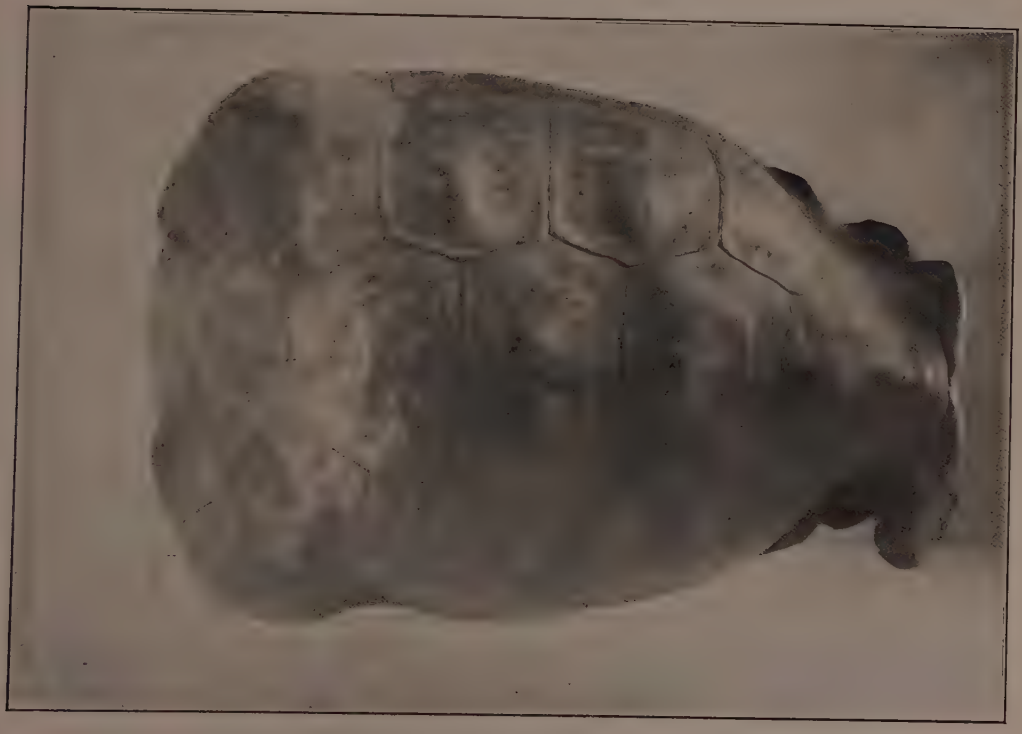

Fig. 2. Testudo ephippium Günther.
Duncan Island. 29.5 inch male. From above.

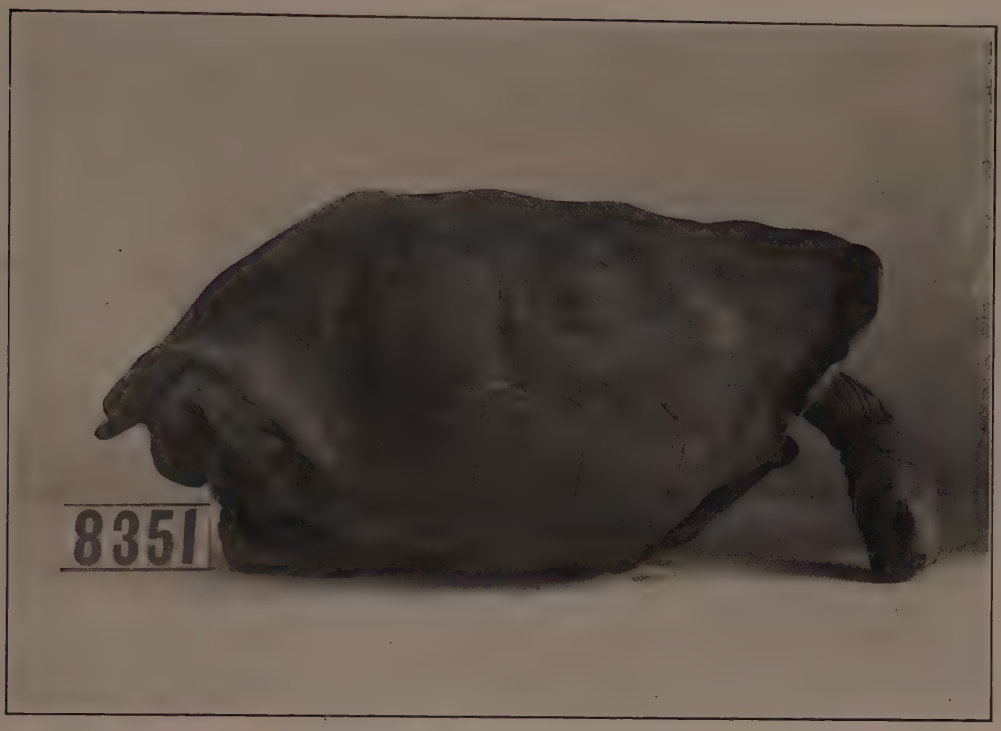


Fig. 1. Testudo ephippium Günther.
Duncan Island. 29.5 inch male. From side.

Fig. 2. Testudo ephippium Günther.
Duncan Island. 29.5 inch male. From in front.

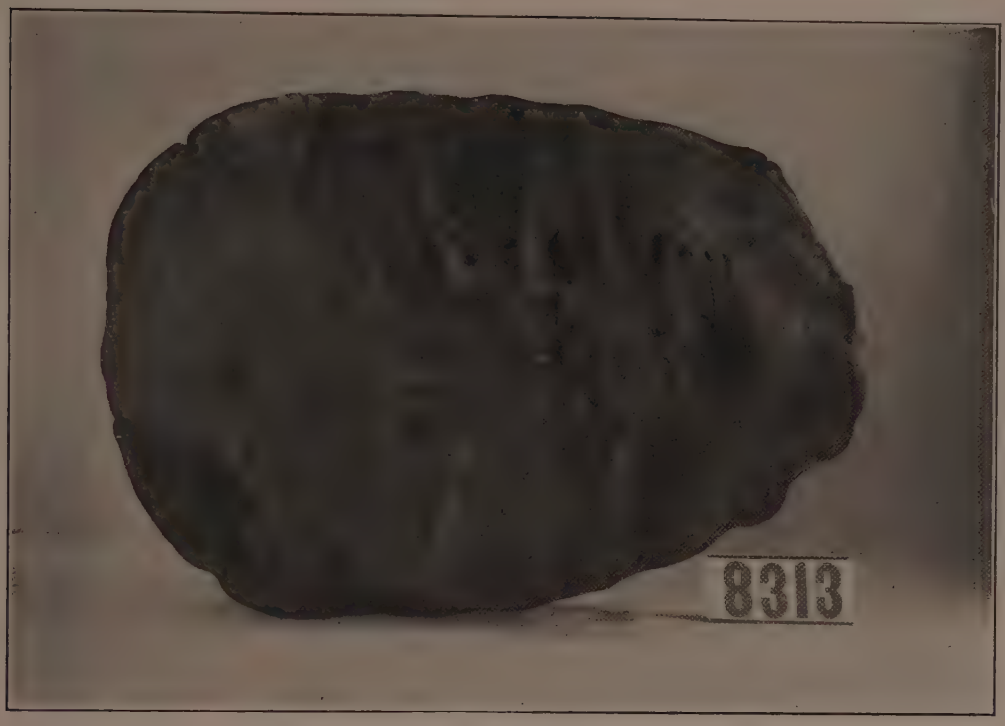


Fig. 1. Testudo ephippium Günther.
Duncan Island. 27.1 inch male. From above.

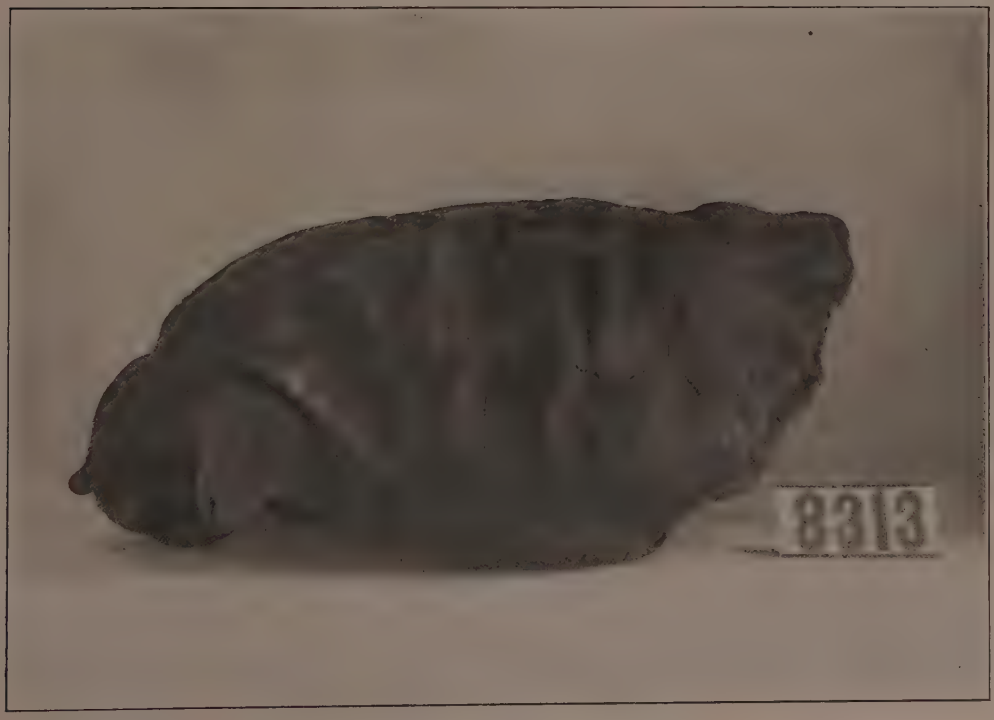


Fig. 2. Testudo ephippium Günther.
Duncan Island. 27.1 inch male. From side.

Fig. 1. Testudo ephippium Günther.
Duncan Island. 27.1 inch male. From in front.

Fig. 2. Testudo ephippium Günther.
Duncan Island. 26.4 inch male. From above.

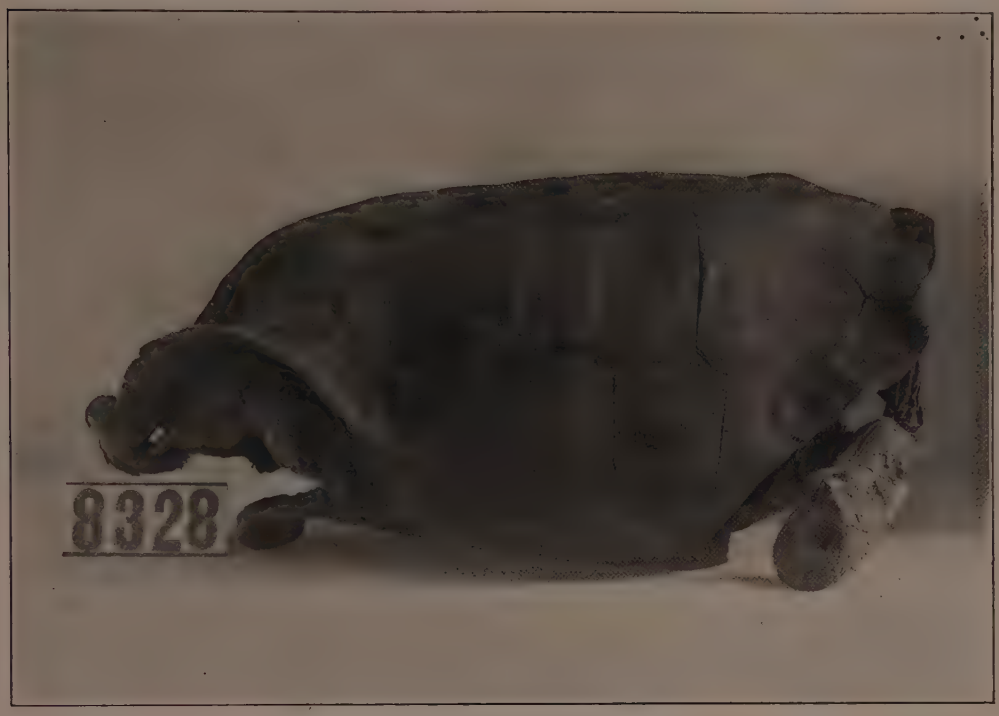


Fig. 1. Testudo ephippium Günther.
Duncan Island. 26.4 inch male. From side.

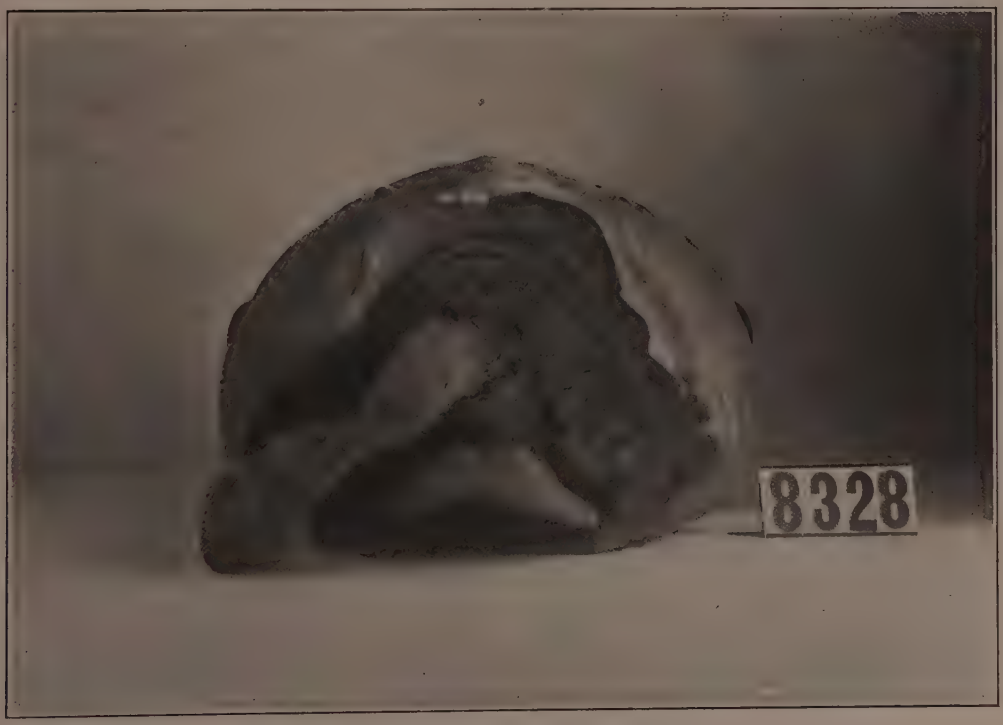


Fig. 2. Testudo ephippium Günther.
Duncan Island. 26.4 inch male. From in front.

Fig. 1. Testudo ephippium Günther.
Duncan Island. 23.4 inch male. From above.

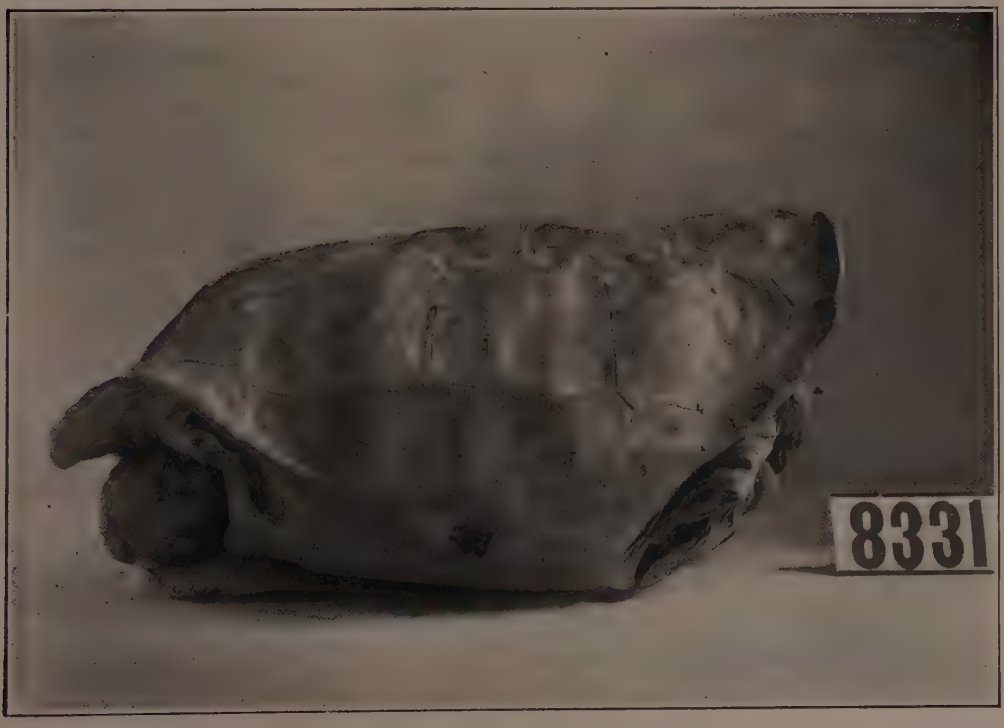


Fig. 2. Testudo ephippium Günther.
Duncan Island. 23.4 inch male. From side.

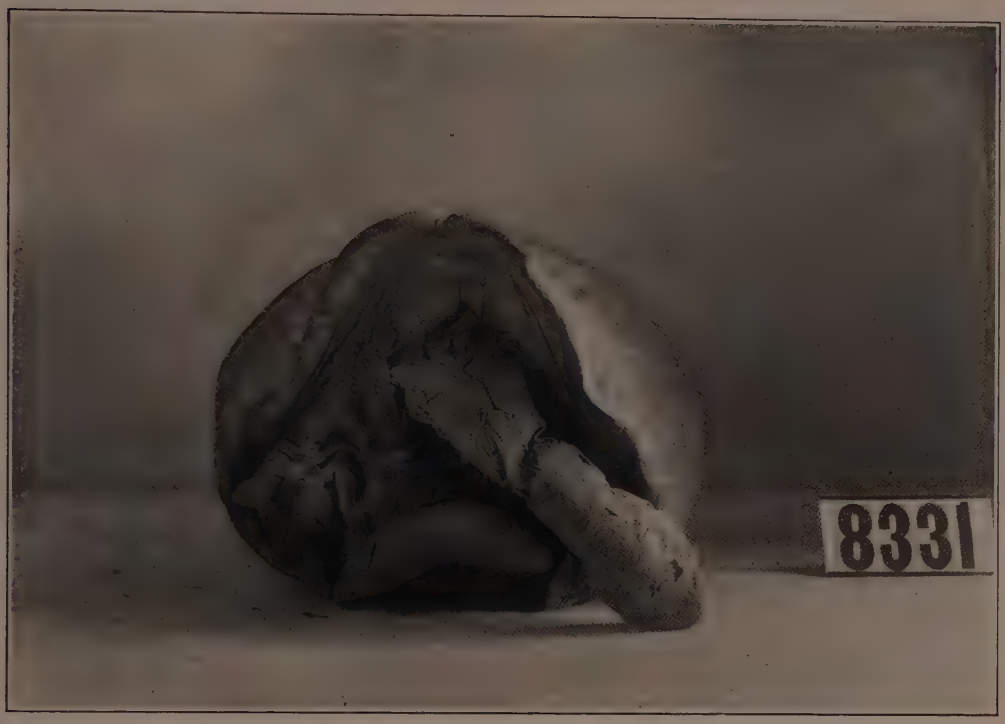


Fig. 1. Testudo ephippium Günther.
Duncan Island. 23.4 inch male. From in front.

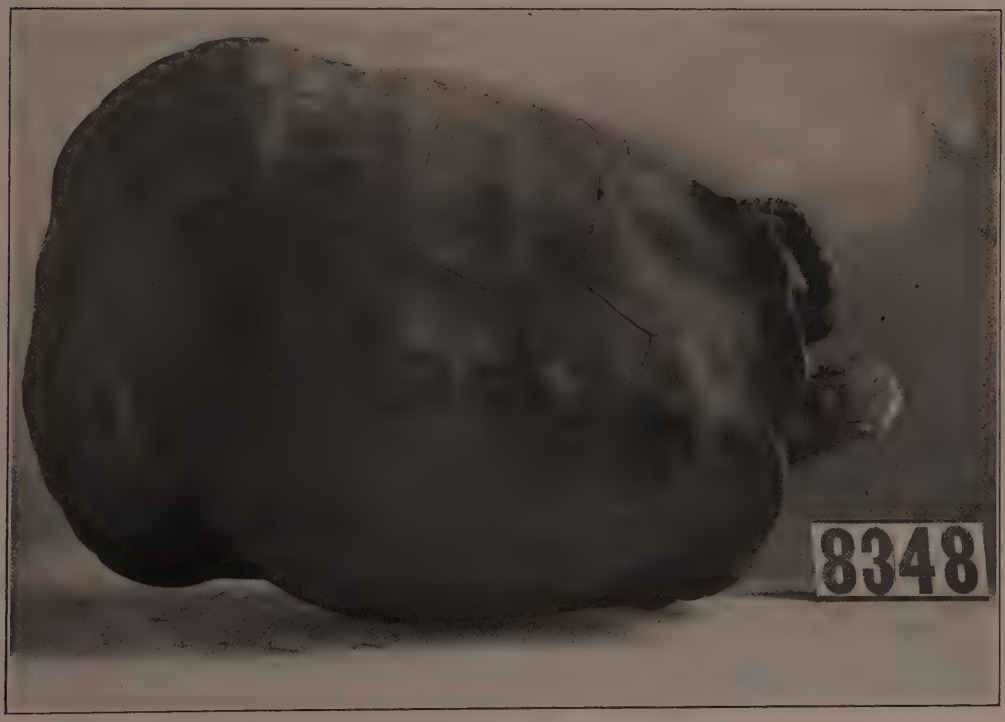


Fig. 2. Testudo ephippium Günther.
Duncan Island. 22.75 inch female. From above.

Fig. 1. Testudo ephippium Günther.
Duncan Island. 22.75 inch female. From side.

Fig. 2. Testudo ephippium Günther.
Duncan Island. 22.75 inch female. From in front.

Fig. 1. Testudo ephippium Günther.
Duncan Island. 21.7 inch female. From above.

Fig. 2. Testudo ephippium Günther.
Duncan Island. 21.7 inch female. From side.

Fig. 1. Testudo ephippium Günther.
Duncan Island. 21.7 inch female. From in front.

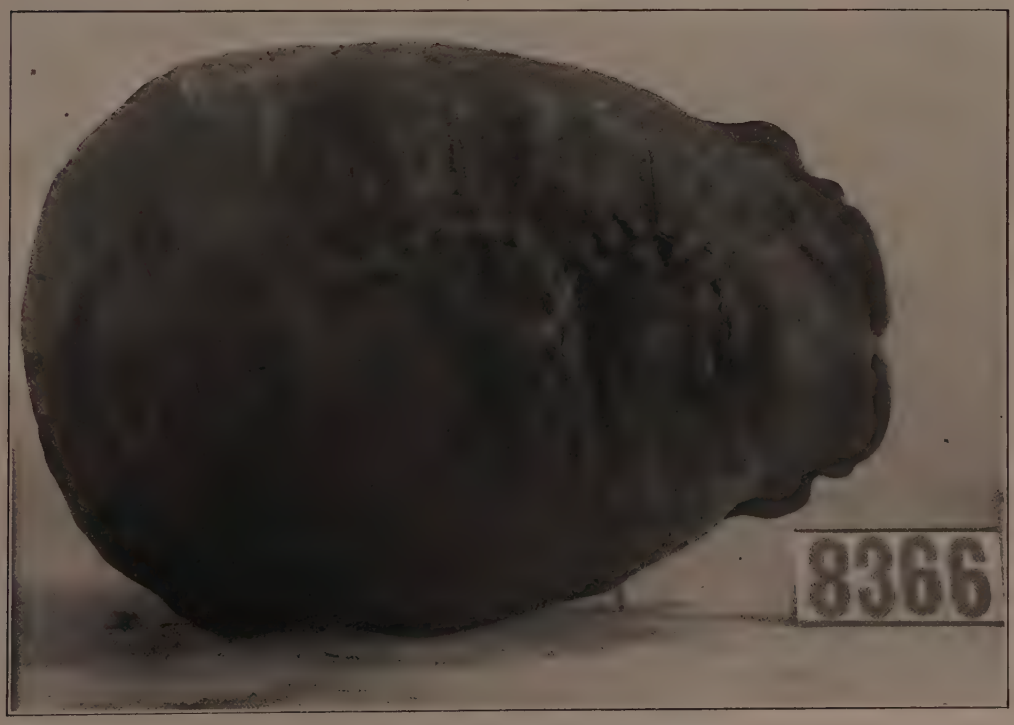


Fig. 2. Testudo ephippium Günther.
Duncan Island. 21.4 inch female. From above.

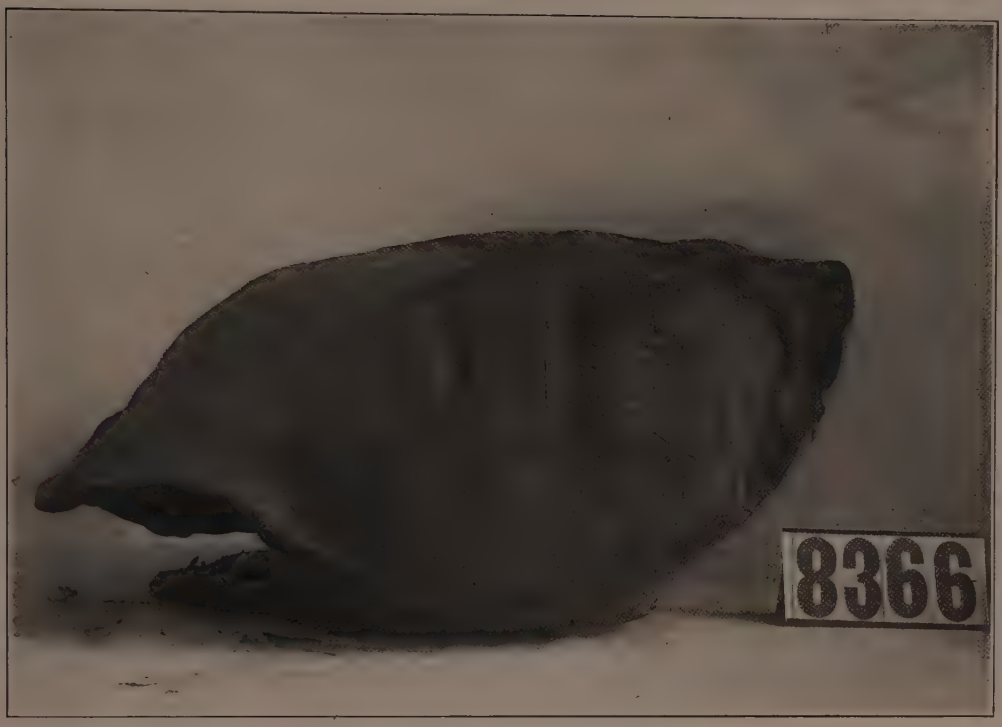


Fig. 1. Testudo ephippium Günther.
Duncan Island. 21.4 inch female. From side.

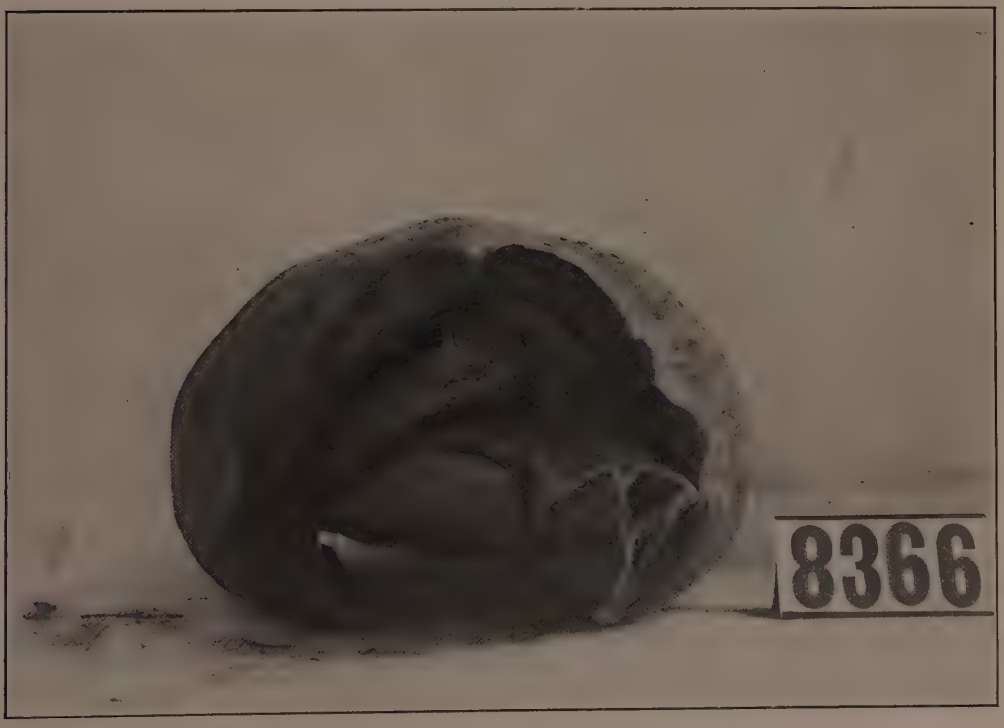


Fig. 2. Testudo ephippium Günther.
Duncan Island. 21.4 inch female. From in front.

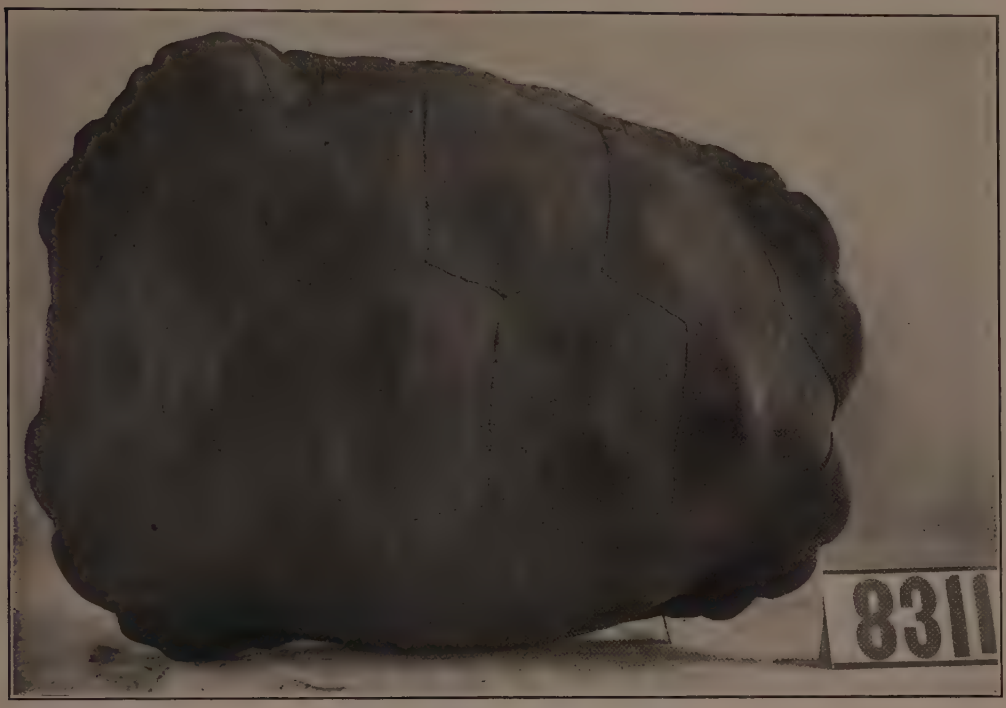


Fig. 1. Testudo ephippium Günther.
Duncan Island. 20.8 inch female. From above.

Fig. 2. Testudo ephippium Günther.
Duncan Island. 20.8 inch female. From side.

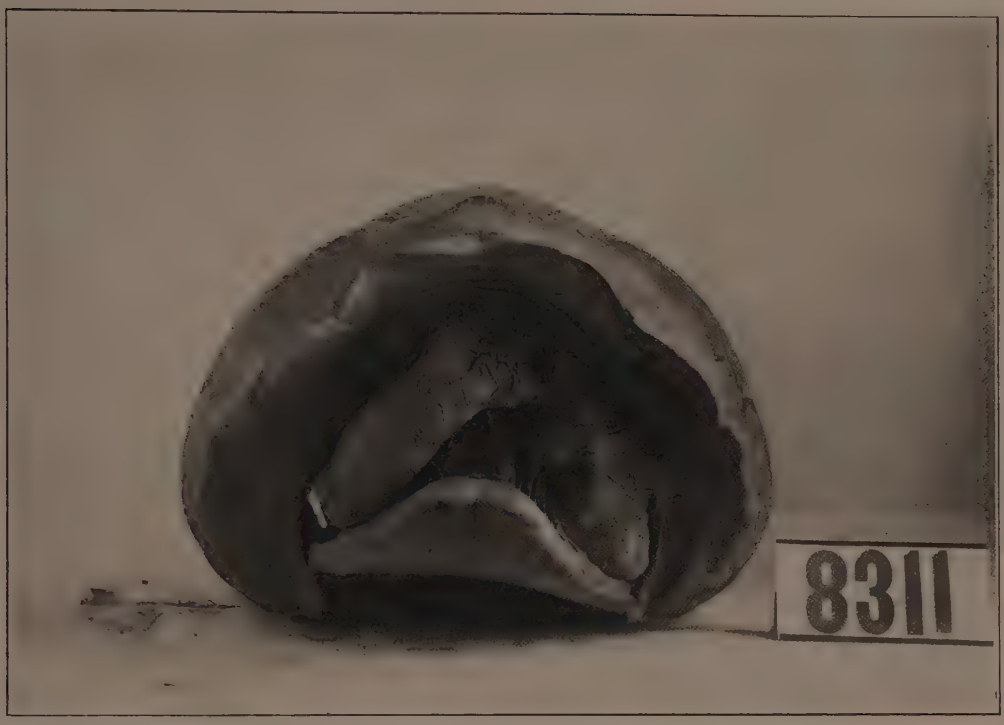


Fig. 1. Testudo ephippium Günther.
Duncan Island. 20.8 inch female. From in front.

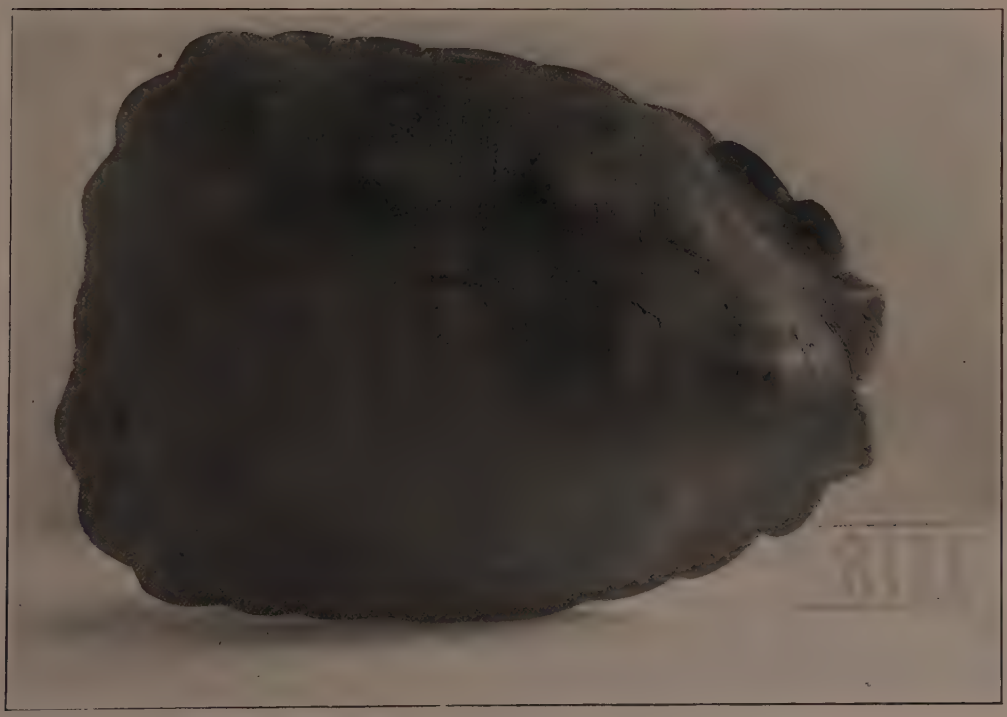

Fig. 2. Testudo hoodensis Van Denburgh.
Hood Island. 22.2 inch male. From above.

Fig. 1. Testudo hoodensis Van Denburgh.
Hood Island. 22.2 inch male. From side.

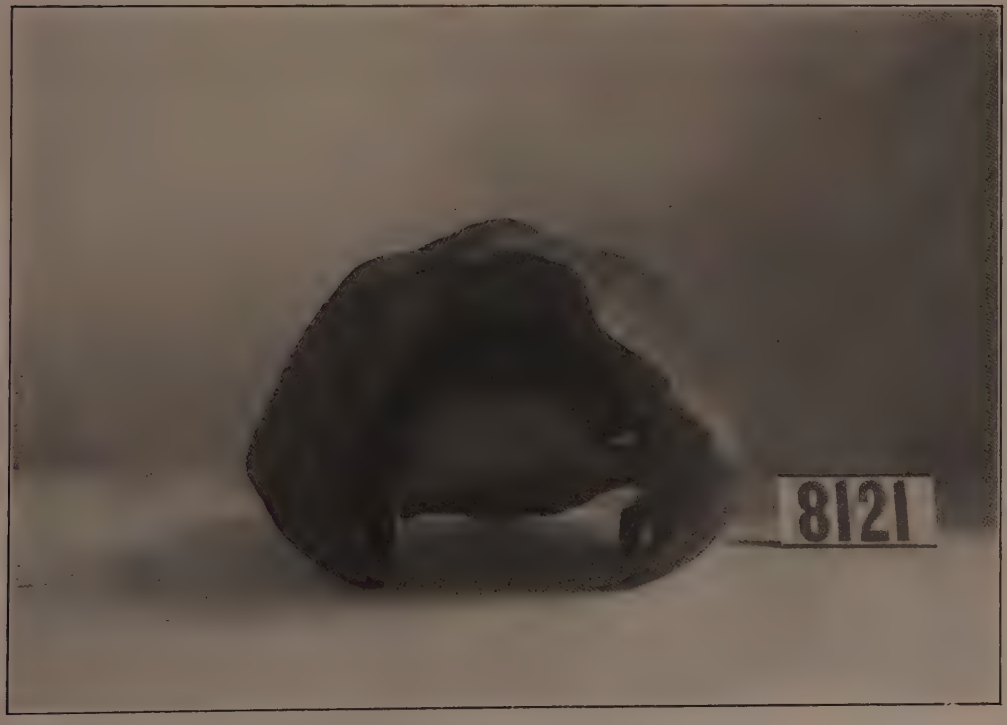


Fig. 2. Testudo hoodensis Van Denburgh.
Hood Island. 22.2 inch male. From in front.

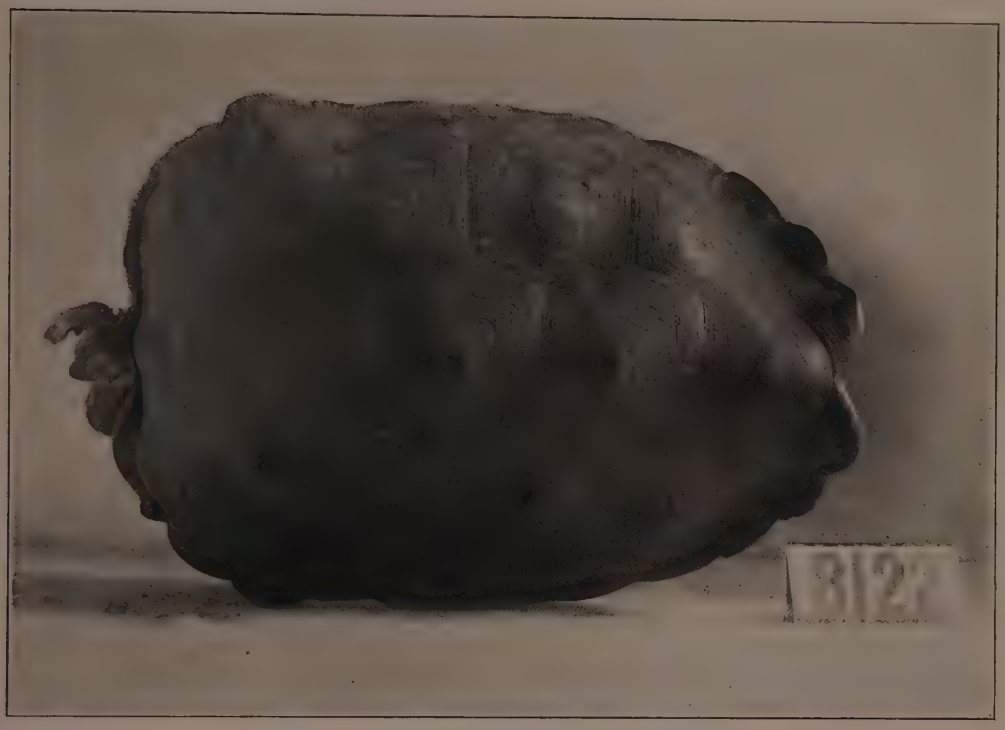


Fig. 1. Testudo hoodensis Van Denburgh.
Hood Island. 21 inch female. From above.

Fig. 2. Testudo hoodensis Van Denburgh.
Hood Island. 21 inch female. From side.

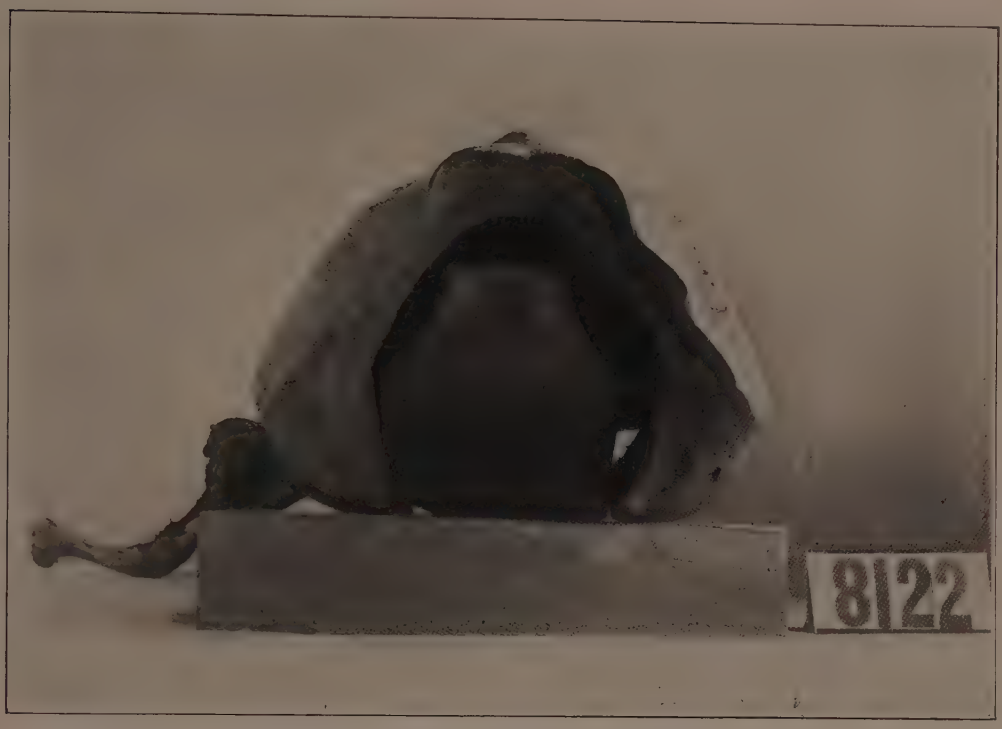


Fig. 1. Testudo hoodensis Van Denburgh.
Hood Island. 21 inch female. From in front.

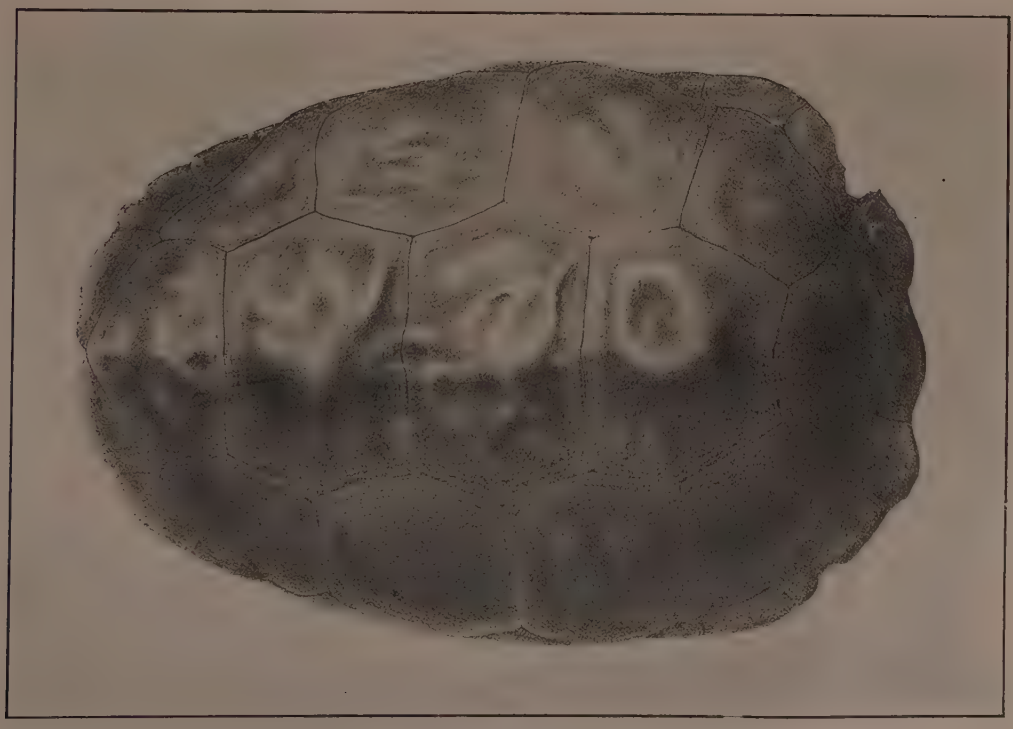

Fig. 2. Testudo elephantopus Harlan.
Charles Island. Adult male. From above. Copied from Günther's plate in Novitates Zoologicæ, Vol. IX.

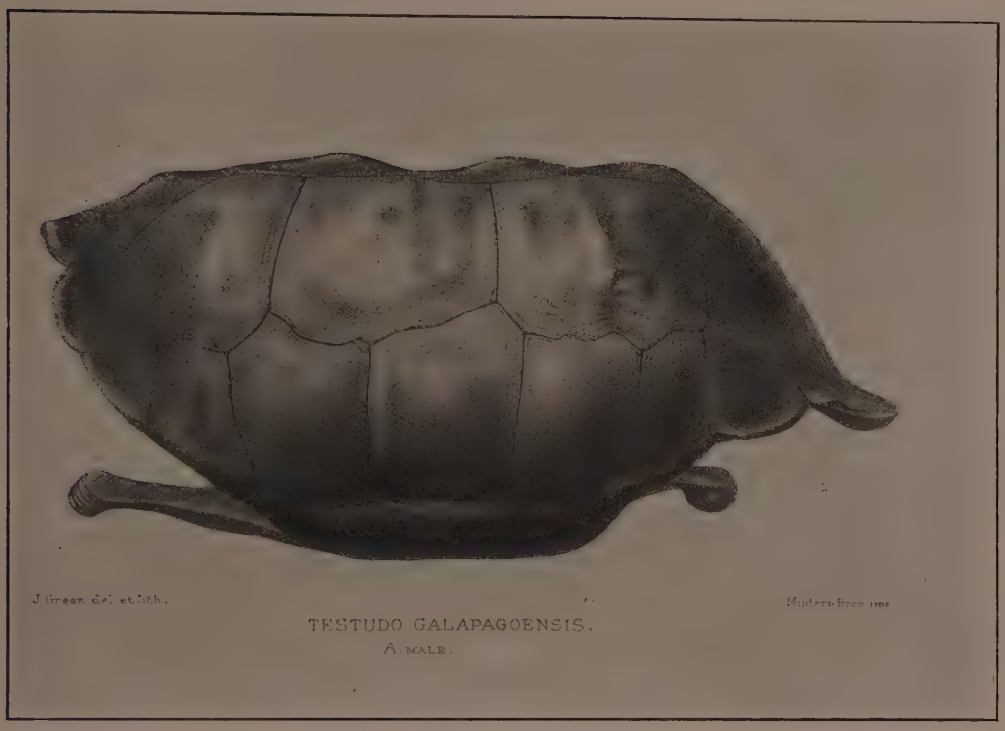


Fig. 1. Testudo elephantopus Harlan.
Charles Island. Adult male. From side. Copied from Günther's plate in Novitates Zoologicæ, Vol. IX.

Fig. 2. Testudo darwini Van Denburgh.
James Island. 40.25 inch male. From above.

Fig. 1. Testudo darwini Van Denburgh.
James Island. 40.25 inch male. From side.

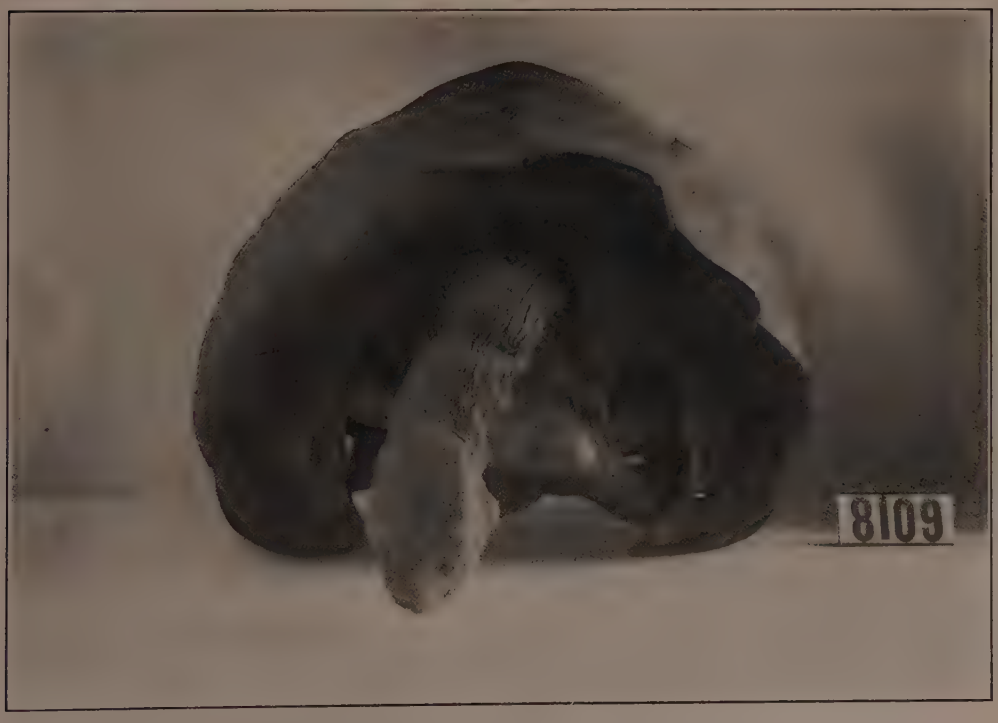


Fig. 2. Testudo darwini Van Denburgh.
James Island. 40.25 inch male. From in front.

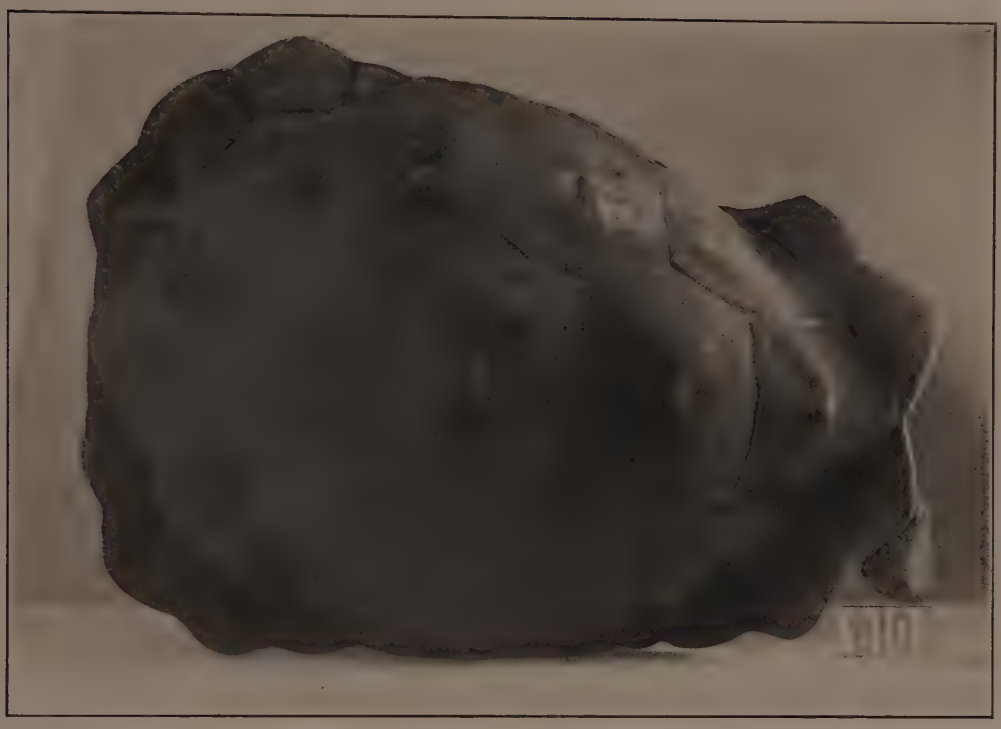

Fig. 1. Testudo darwini Van Denburgh.
James Island. 38 inch male. From above.

Fig. 2. Testudo darwini Van Denburgh.
James Island. 38 inch male. From side.

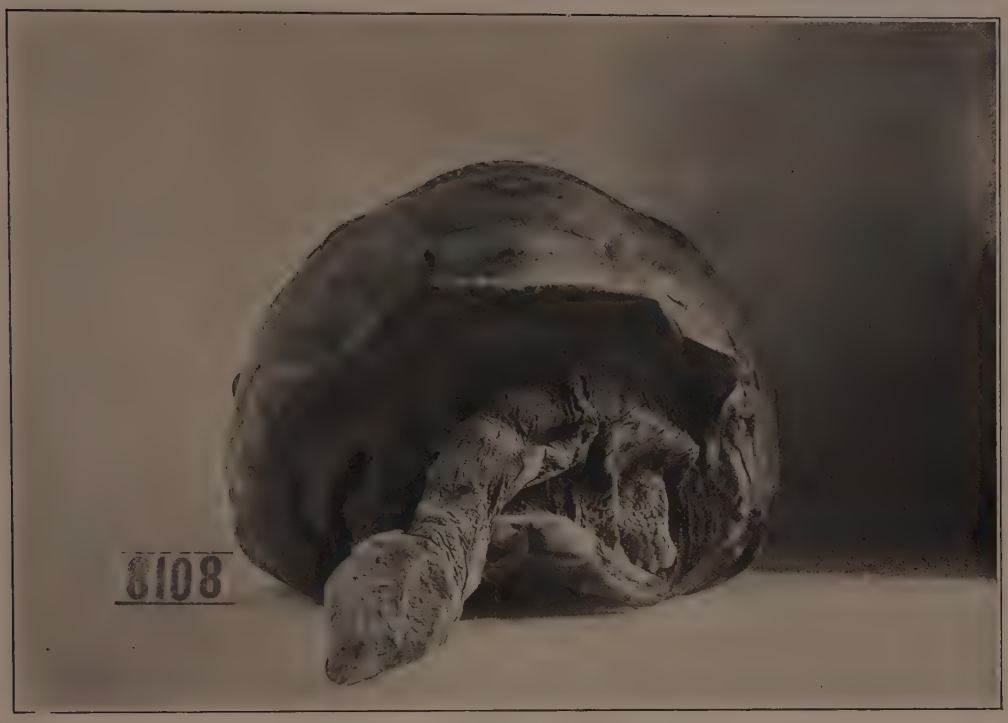


Fig. 1. Testudo darwini Van Denburgh.
James Island. 38 inch male. From in front.

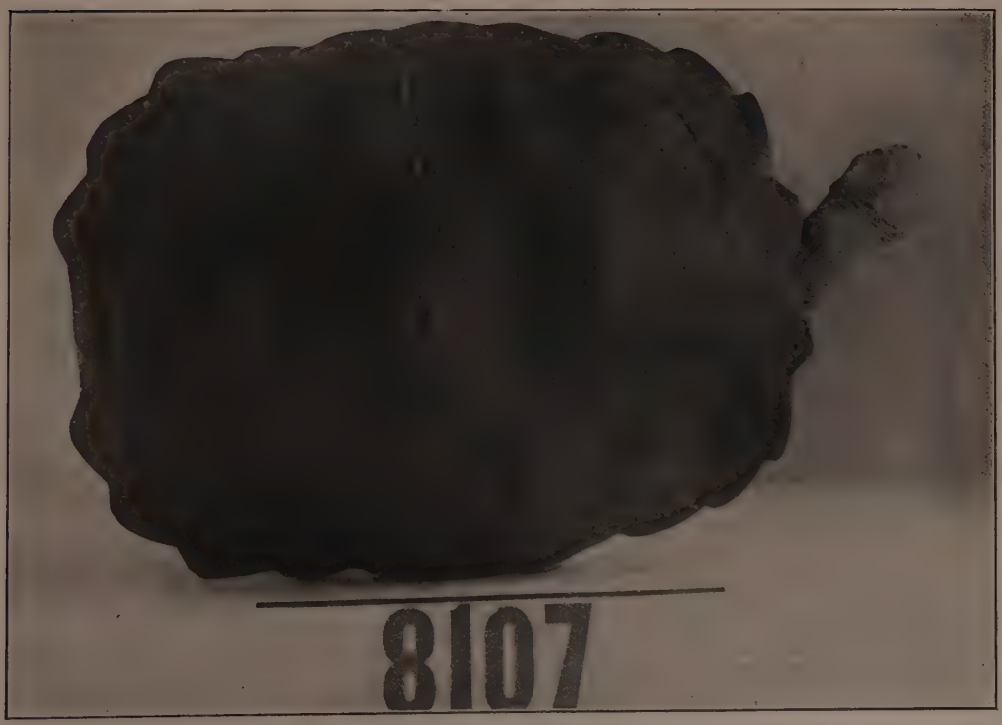


Fig. 2. Testudo darwini Van Denburgh.
James Island. 21 inch male. From above.

Fig. 1. Testudo darwini Van Denburgh.
James Island. 21 inch male. From side.

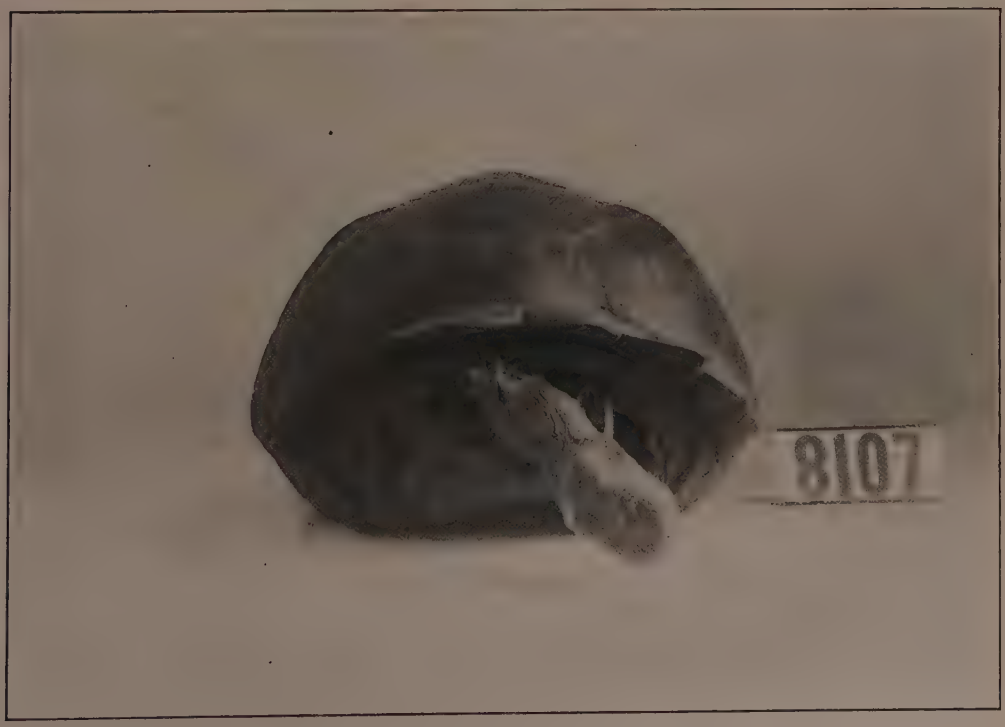


Fig. 2. Testudo darwini Van Denburgh.
James Island. 21 inch male. From in front.

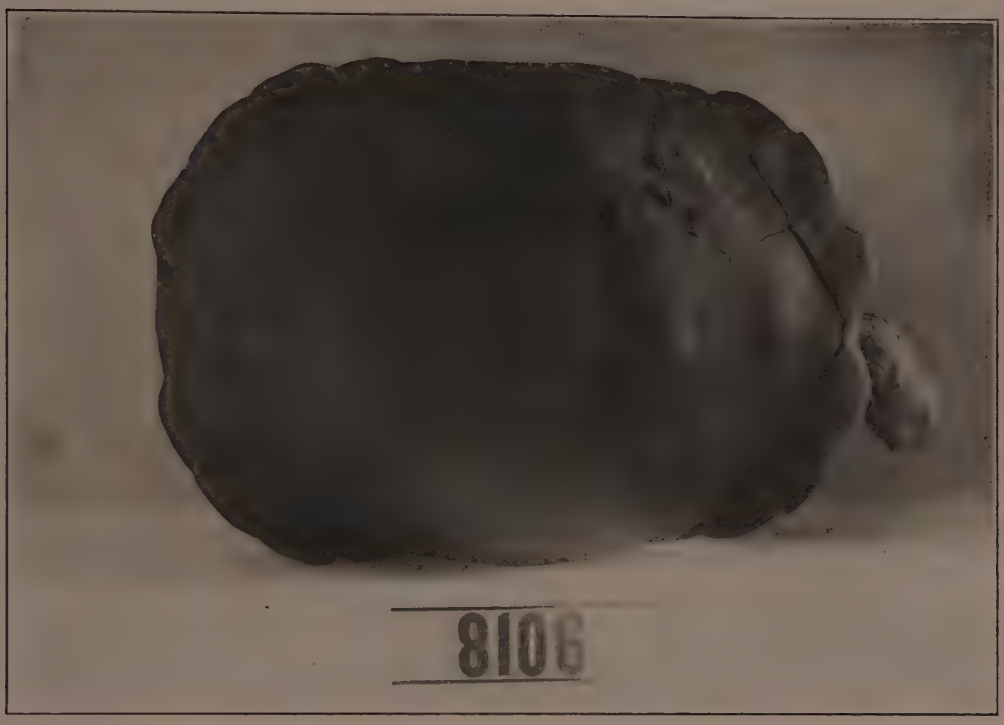


Fig. 1. Testudo darwini Van Denburgh.
James Island. 30 inch female. From above.

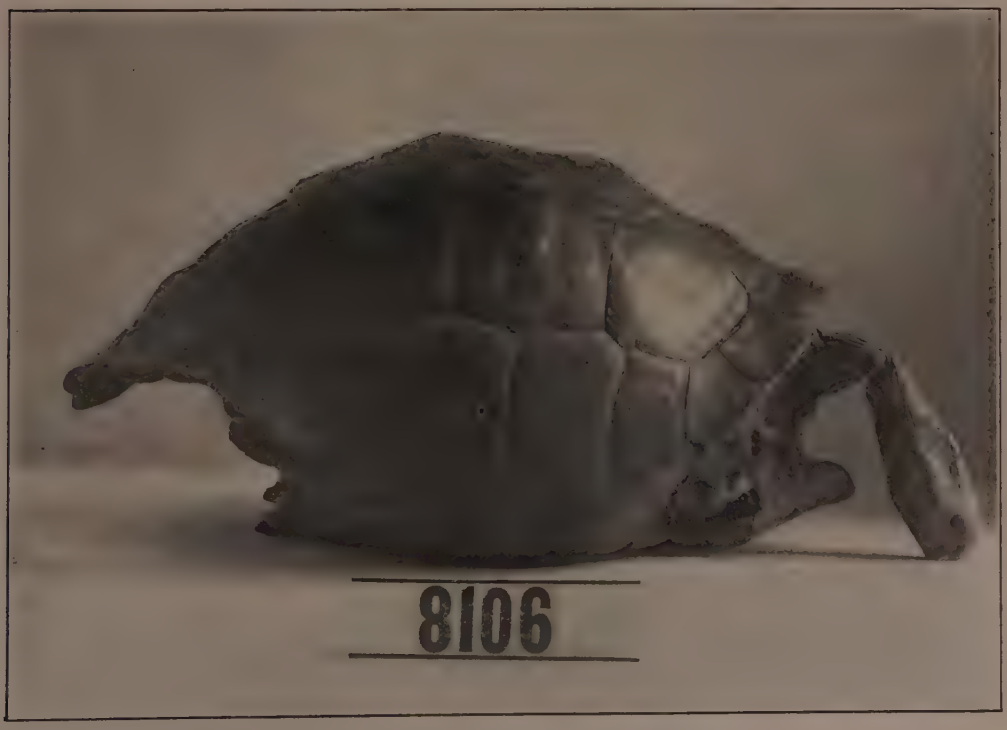


Fig. 2. Testudo darwini Van Denburgh.
James Island. 30 inch female. From side.

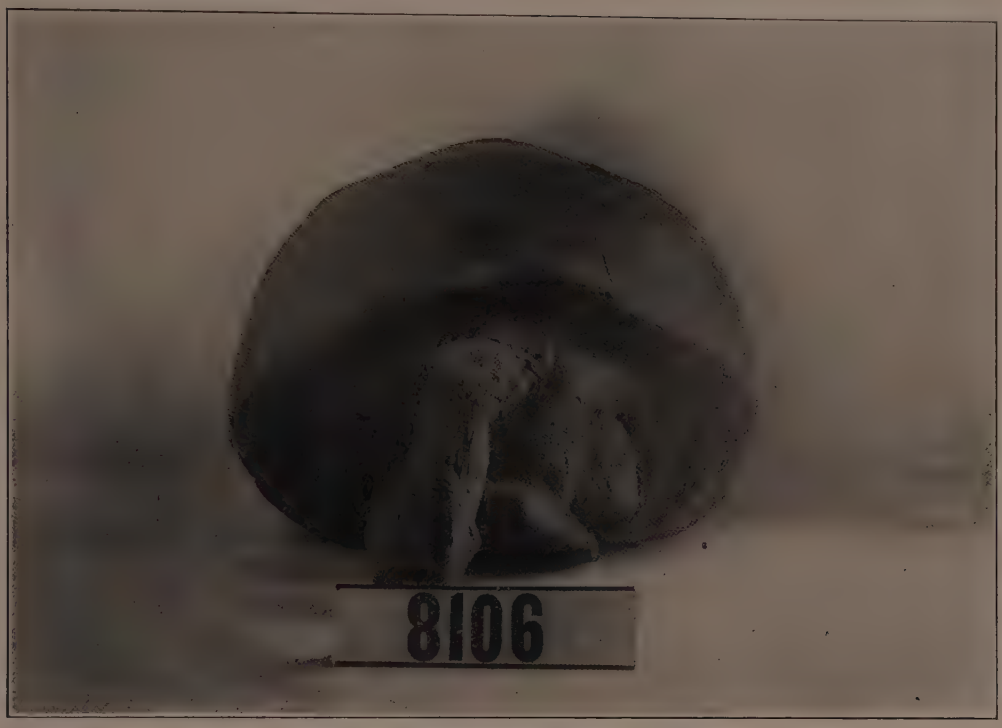


Fig. 1. Testudo darwini Van Denburgh.
James Island. 30 inch female. From in front.

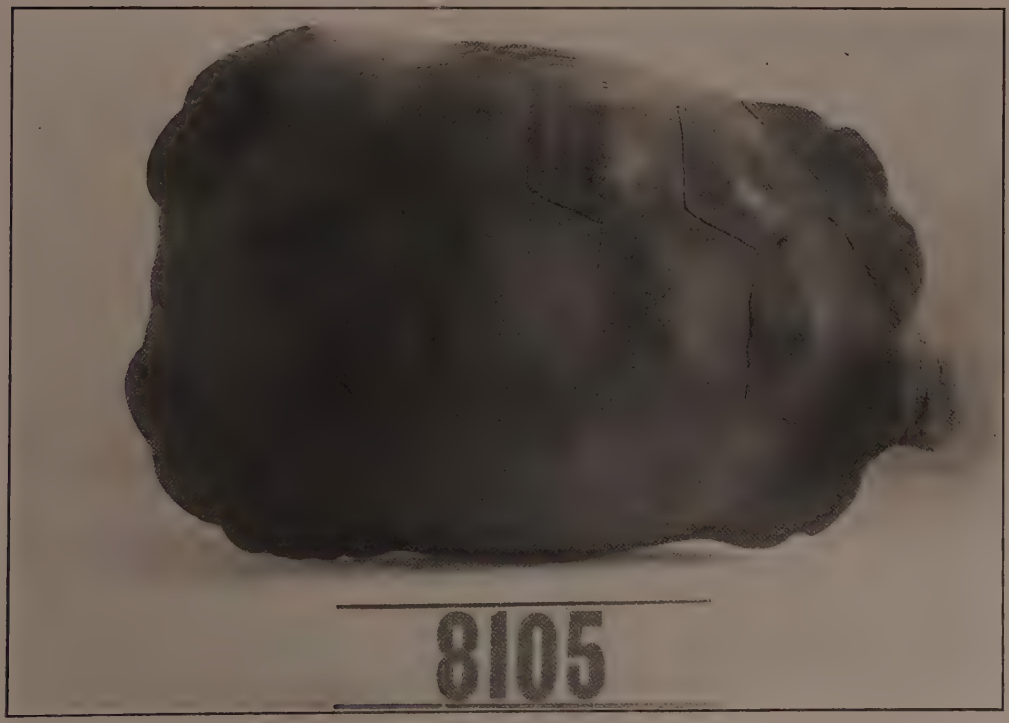


Fig. 2. Testudo darwini Van Denburgh.
James Island. 25.75 inch female. From above.

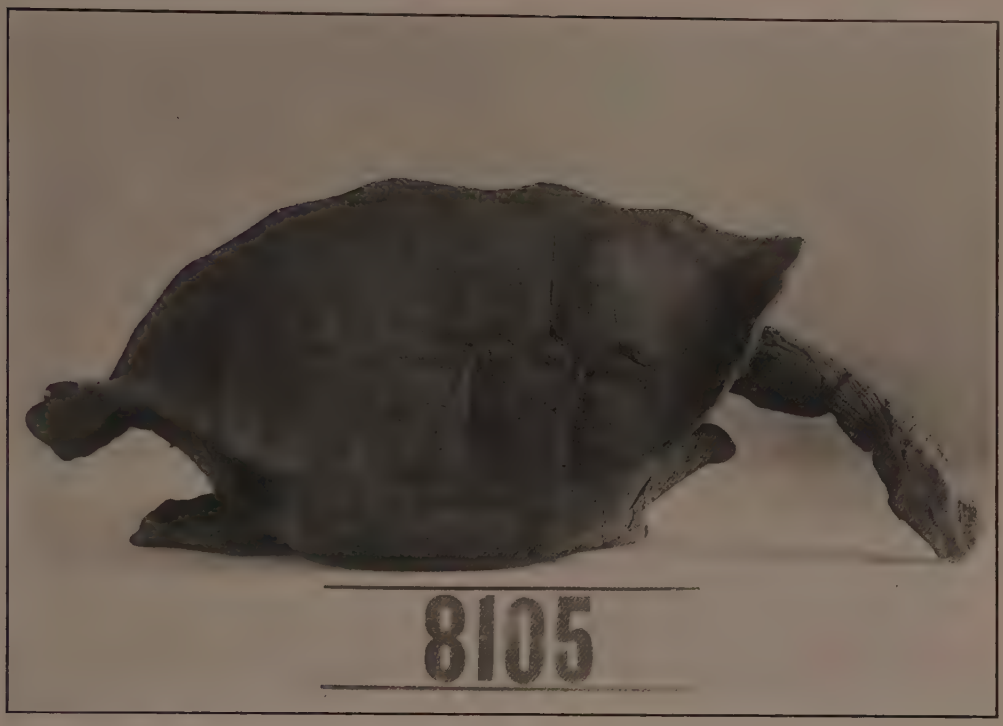


Fig. 1. Testudo darwini Van Denburgh.
James Island. 25.75 inch female. From side.

Fig. 2. Testudo darwini Van Denburgh.
James Island. 25.75 inch female. From in front.

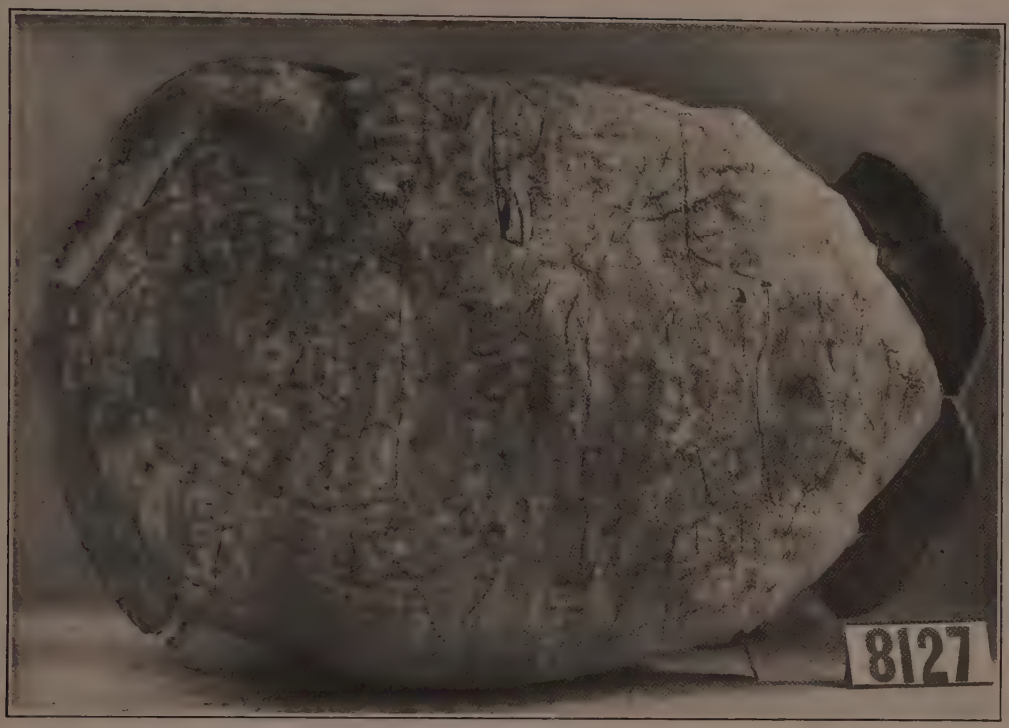


Fig. 1. Testudo chathamensis Van Denburgh.
Chatham Island. 35.25 inch bony carapace of male. From above.

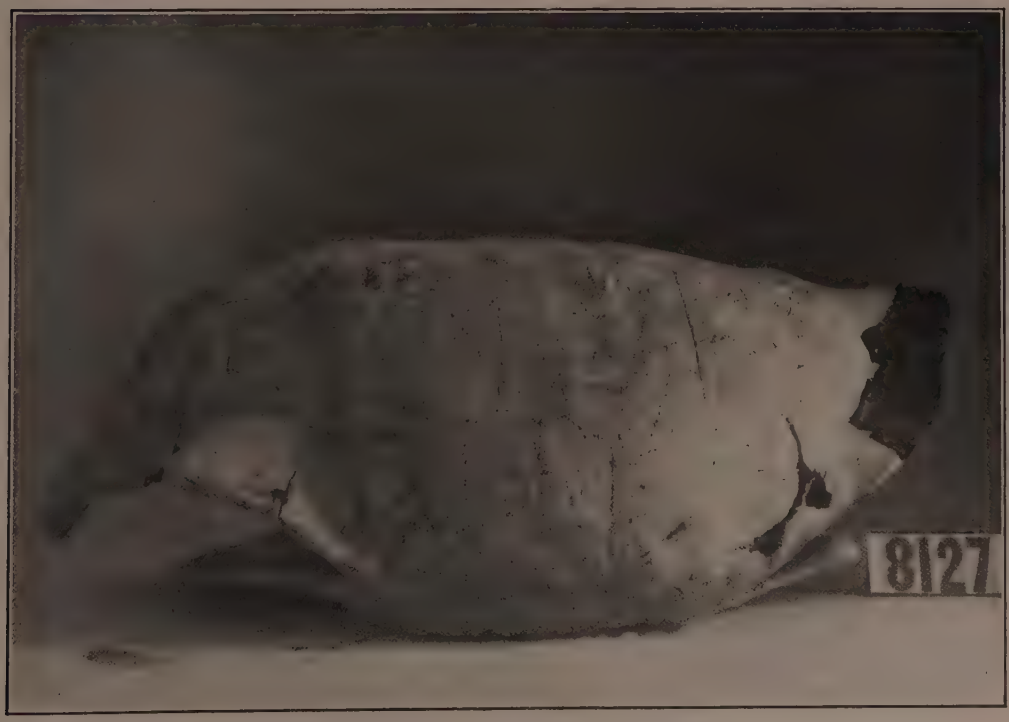


Fig. 2. Testudo chathamensis Van Denburgh.
Chatham Island. 35.25 inch bony carapace of male. From side.

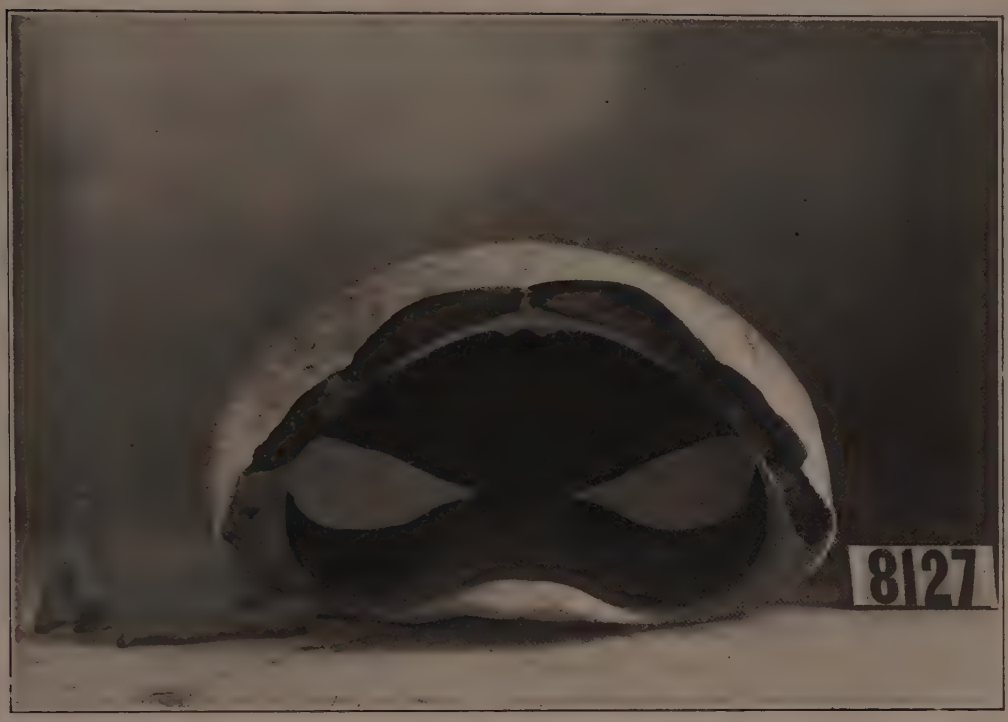


Fig. 1. Testudo chathamensis Van Denburgh.
Chatham Island. 35.25 inch bony carapace of male. From in front.

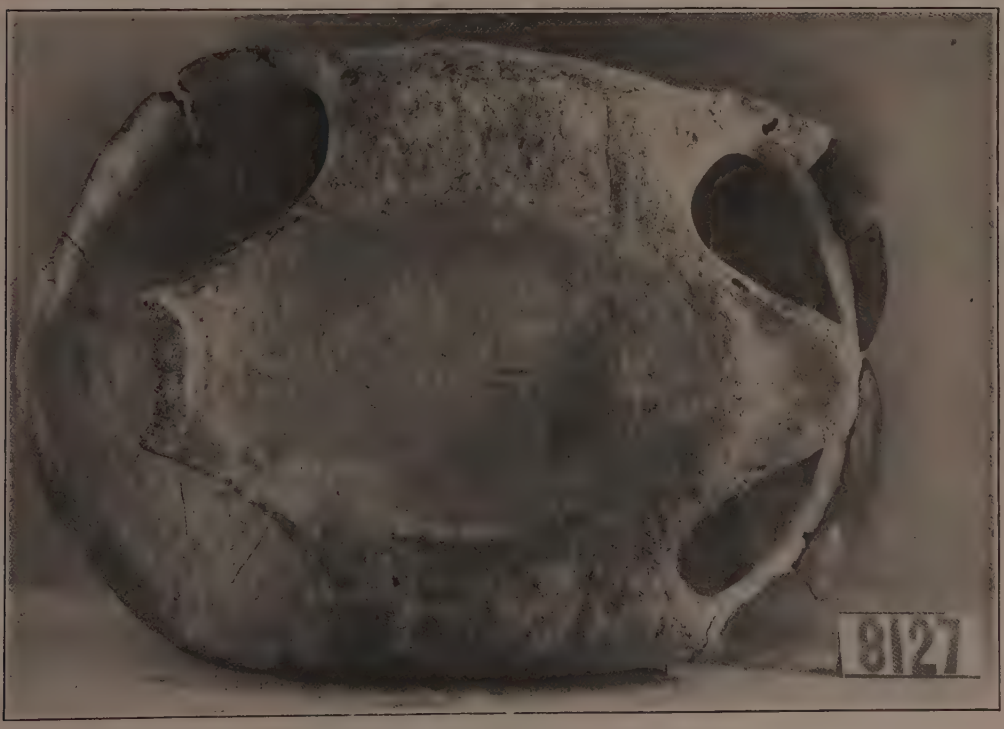


Fig. 2. Testudo chathamensis Van Denburgh.
Chatham Island. 35.25 inch bony carapace of male. From below.

Fig. 1. Testudo chathamensis Van Denburgh.
Chatham Island. 25.25 inch bony carapace. From above.

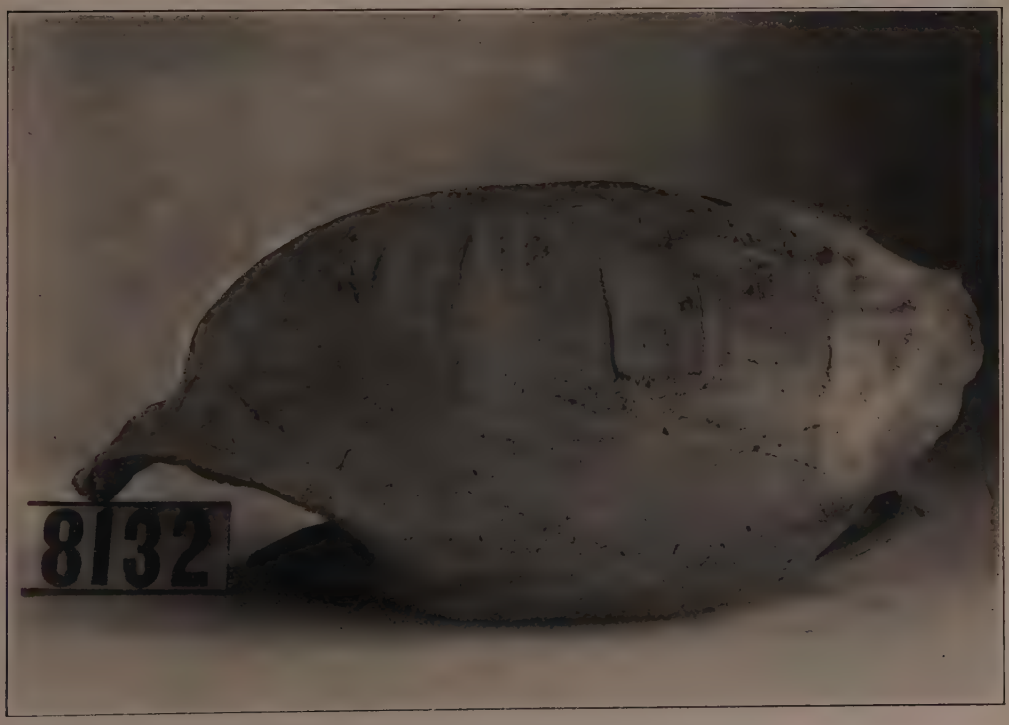


Fig. 2. Testudo chathamensis Van Denburgh.
Chatham Island. 25.25 inch bony carapace. From side.

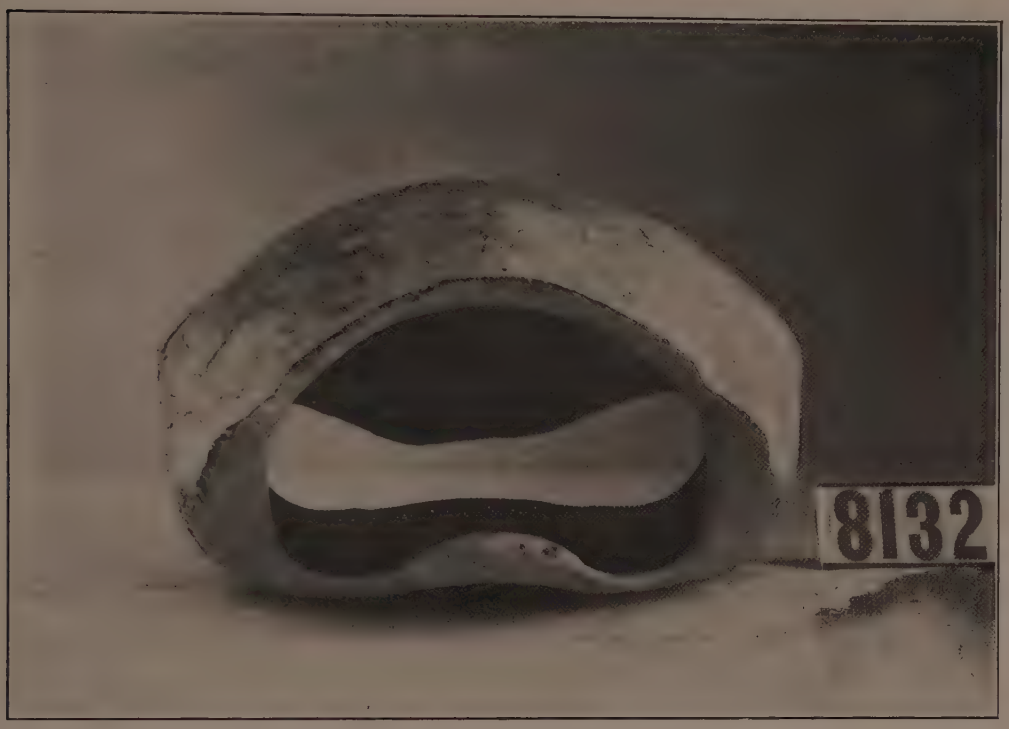


Fig. 1. Testudo chathamensis Van Denburgh.
Chatham Island. 25.25 inch bony carapace. From in front.

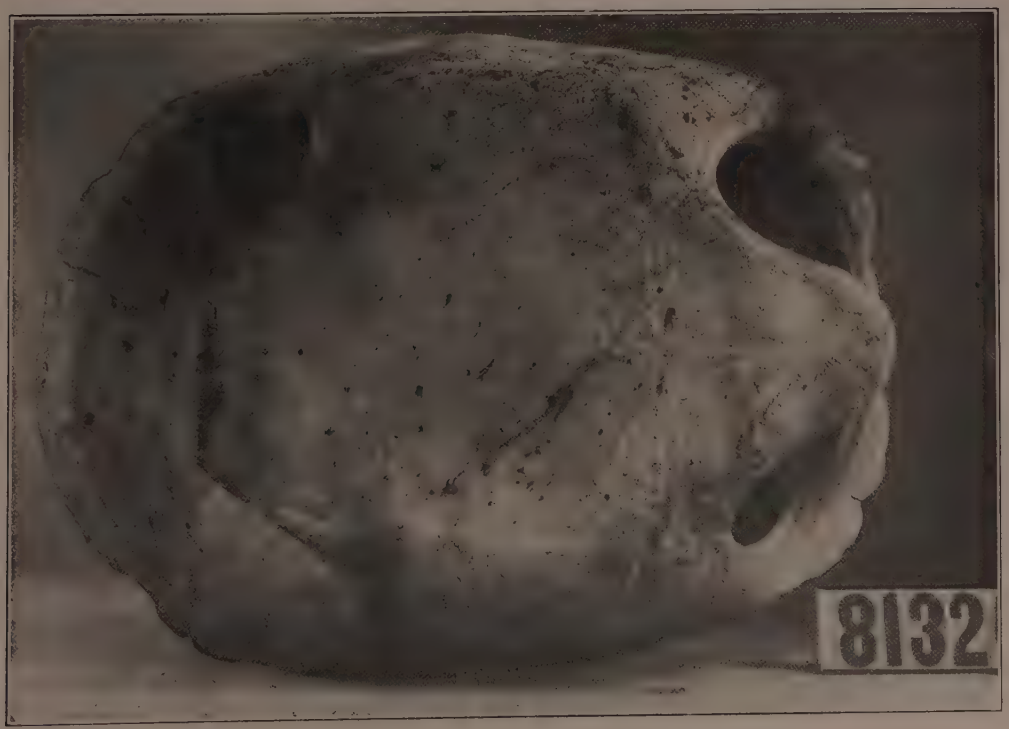


Fig. 2. Testudo chathamensis Van Denburgh.
Chatham Island. 25.25 inch bony carapace. From below.

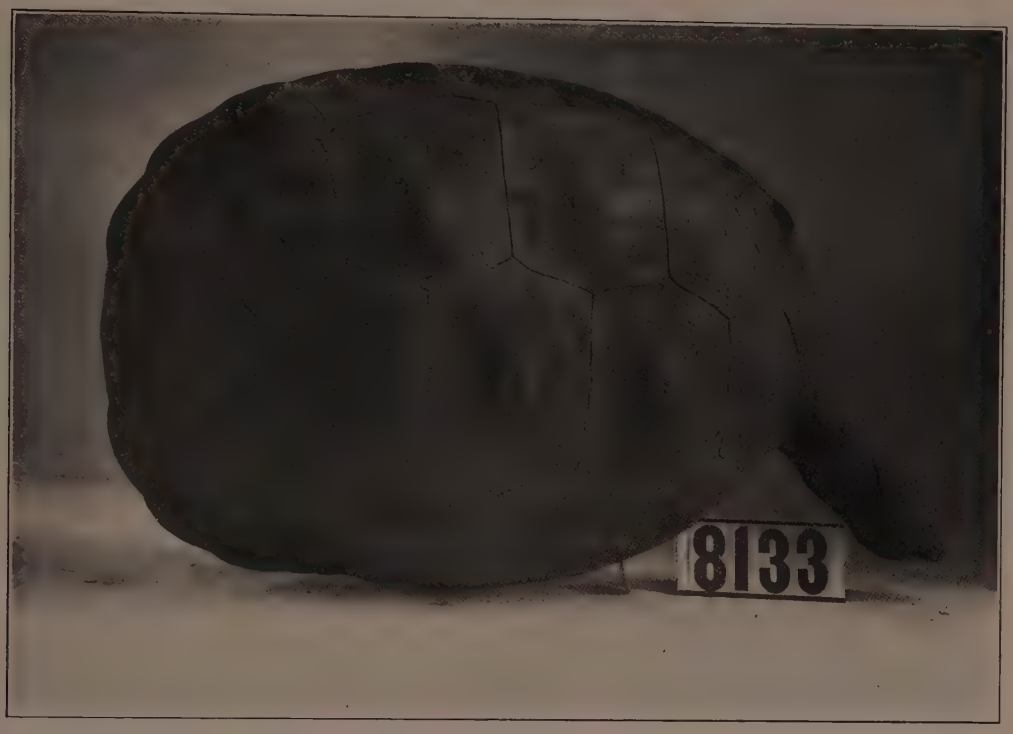


Fig. 1. Testudo chathamensis Van Denburgh.
Chatham Island. 22.5 inch adult female. From above.

Fig. 2. Testudo chathamensis Van Denburgh.
Chatham Island. 22.5 inch adult female. From side.

Fig. 1. Testudo chathamensis Van Denburgh.
Chatham Island. 22.5 inch adult female. From in front.

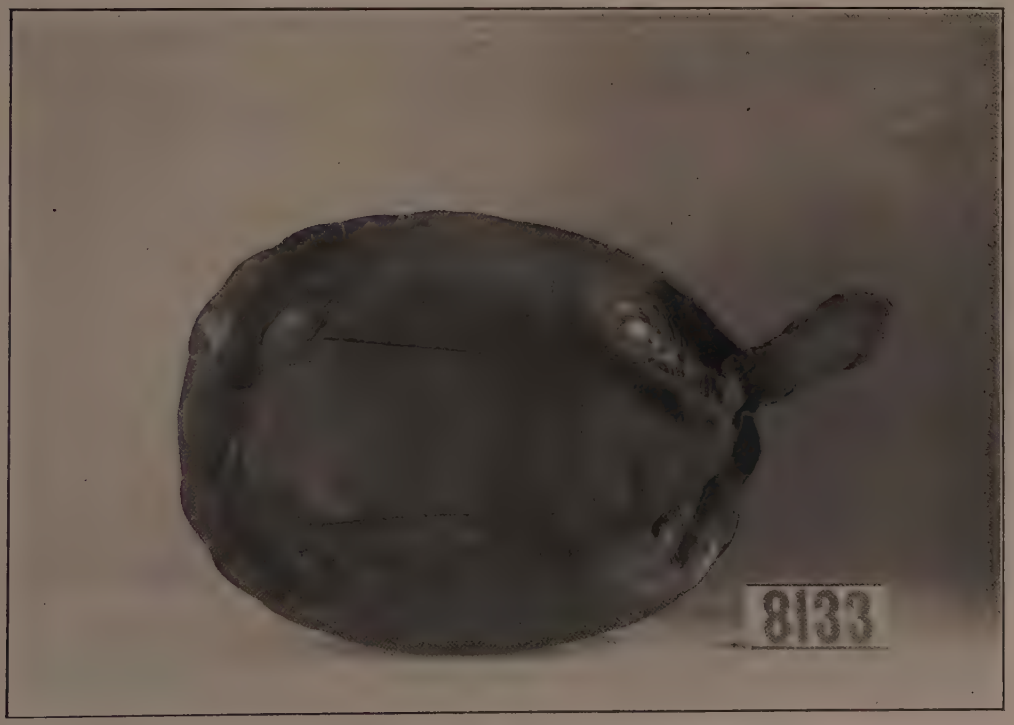


Fig. 2. Testudo chathamensis Van Denburgh.
Chatham Island. 22.5 inch adult female. From below.

Fig. 1. Testudo microphyes Günther.
Tagus Cove, Albemarle Island. 40.5 inch male. From above.

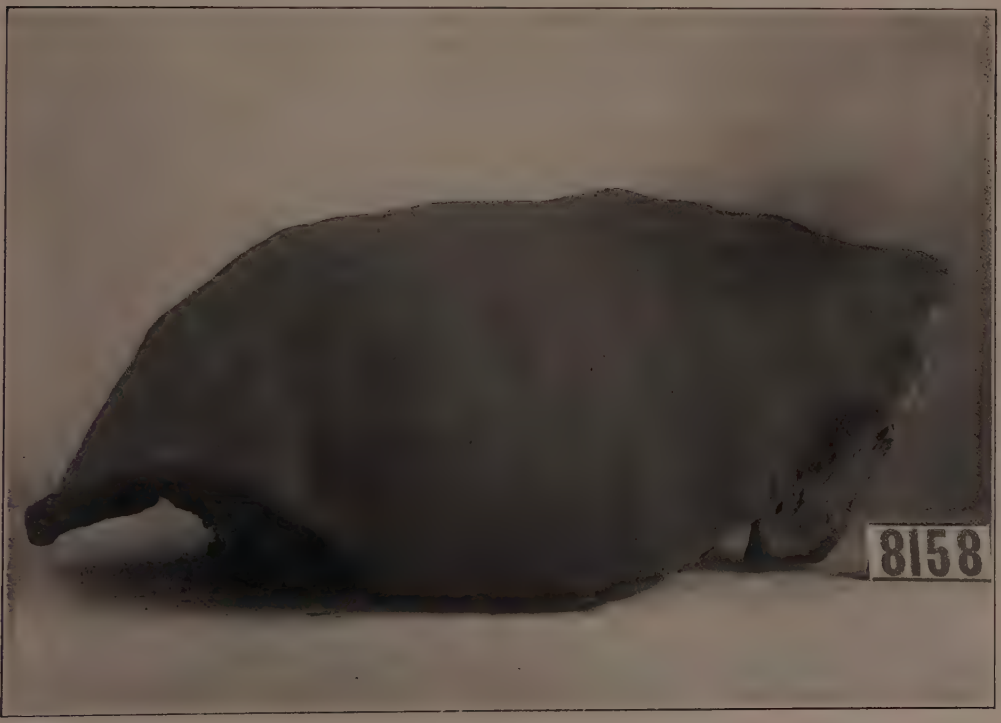


Fig. 2. Testudo microphyes Günther.
Tagus Cove, Albemarle Island. 40.5 inch male. From side.

Fig. 1. Testudo microphyes Günther.
Tagus Cove, Albemarle Island. 40.5 inch male. From in front.

Fig. 2. Testudo microphyes Günther.
Tagus Cove, Albemarle Island. 37.8 inch male. From above.

Fig. 1. Testudo microphyes Günther.
Tagus Cove, Albemarle Island. 37.8 inch male. From side.

Fig. 2. Testudo microphyes Günther.
Tagus Cove, Albemarle Island. 37.8 inch male. From in front.

Fig. 1. Testudo microphyes Günther.
Tagus Cove, Albemarle Island. 37.5 inch male. From above.

Fig. 2. Testudo microphyes Günther.
Tagus Cove, Albemarle Island. 37.3 inch male. From above.

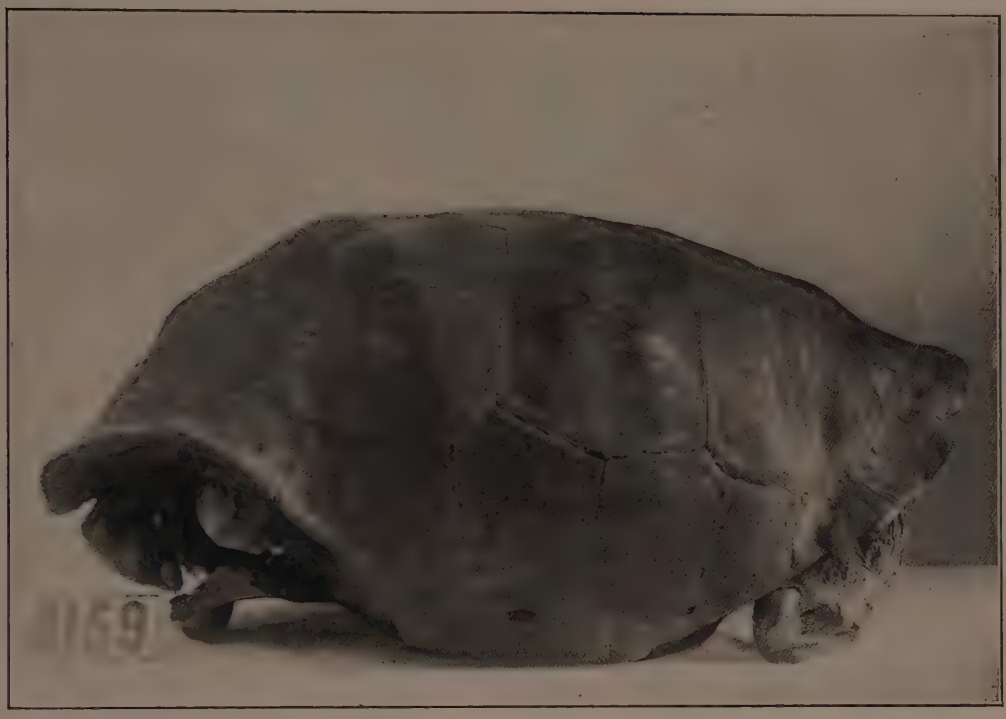

Fig. 1. Testudo microphyes Günther.
Tagus Cove, Albemarle Island. 37.3 inch male. From side.

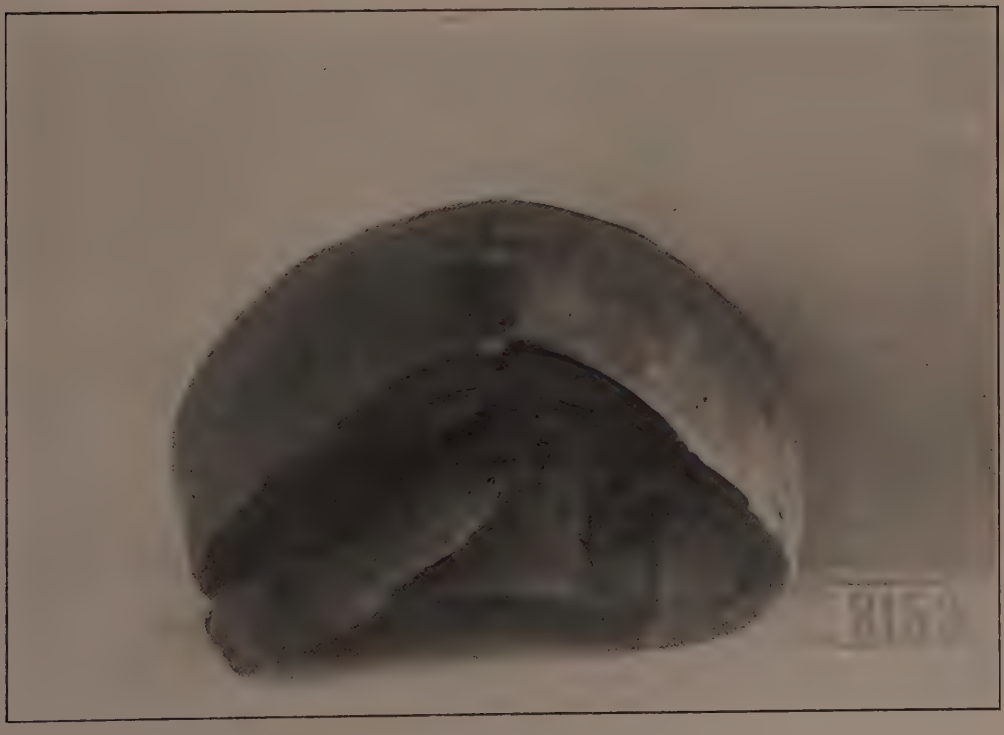

Fig. 2. Testudo microphyes Günther.
Tagus Cove, Albemarle Island. 37.3 inch male. From in front.

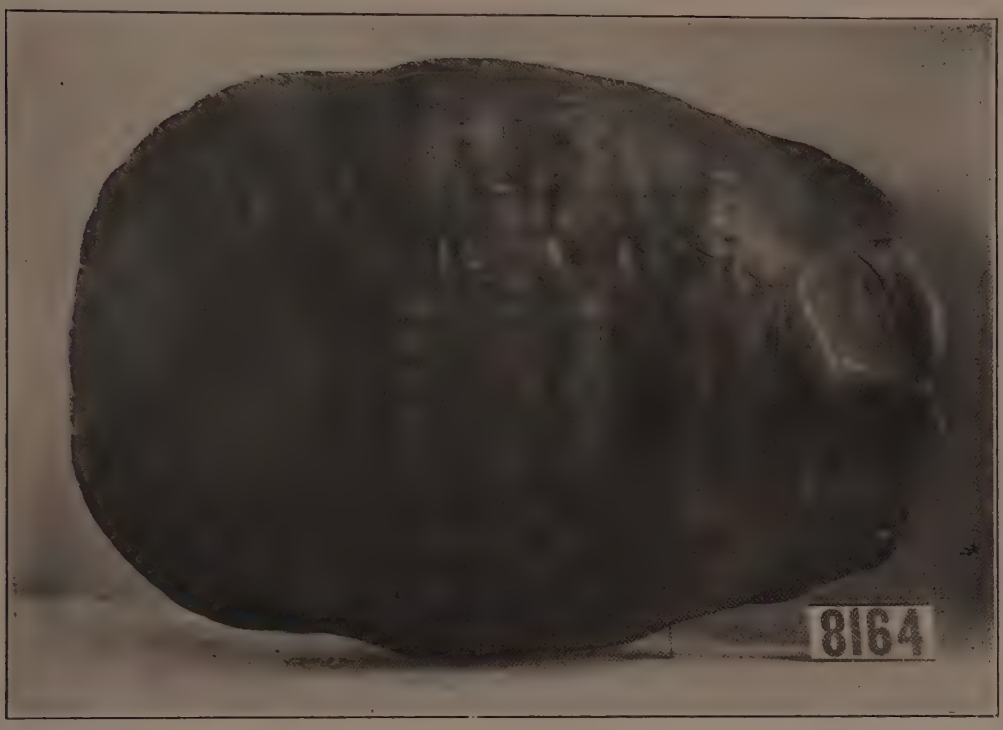


Fig. 1. Testudo microphyes Günther.
Tagus Cove, Albemarle Island. 36.25 inch male. From above.

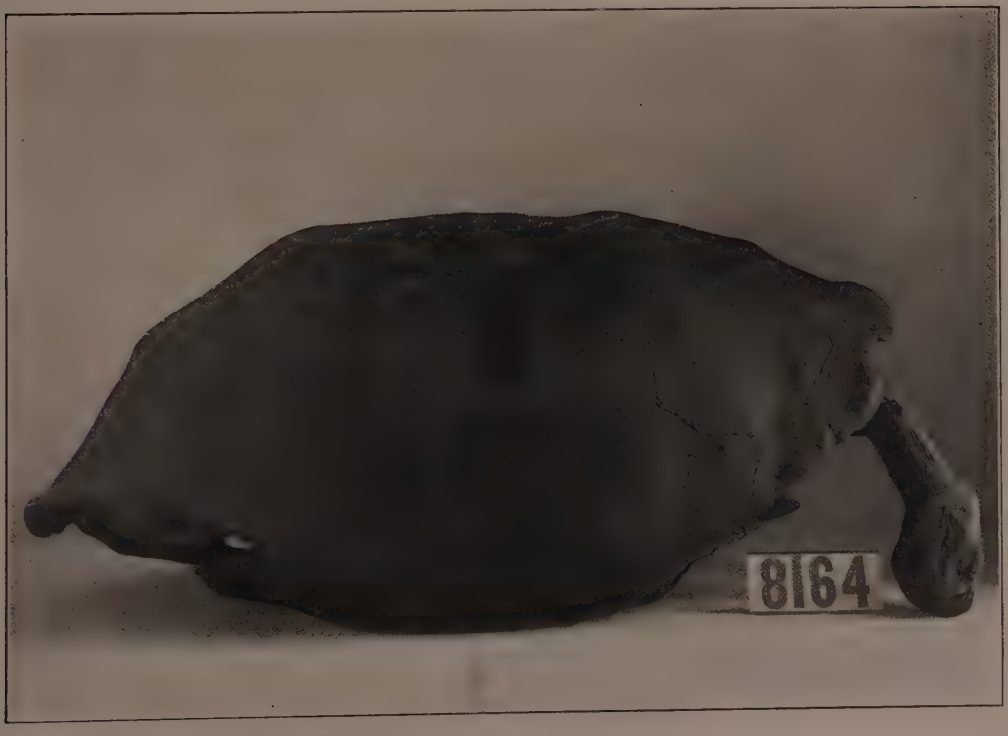


Fig. 2. Testudo microphyes Günther.
Tagus Cove, Albemarle Island. 36.25 inch male. From side.

Fig. 1. Testudo microphyes Günther.
Tagus Cove, Albemarle Island. 36.25 inch male. From in front.

Fig. 2. Testudo microphyes Günther.
Tagus Cove, Albemarle Island. 36 inch male. From above.

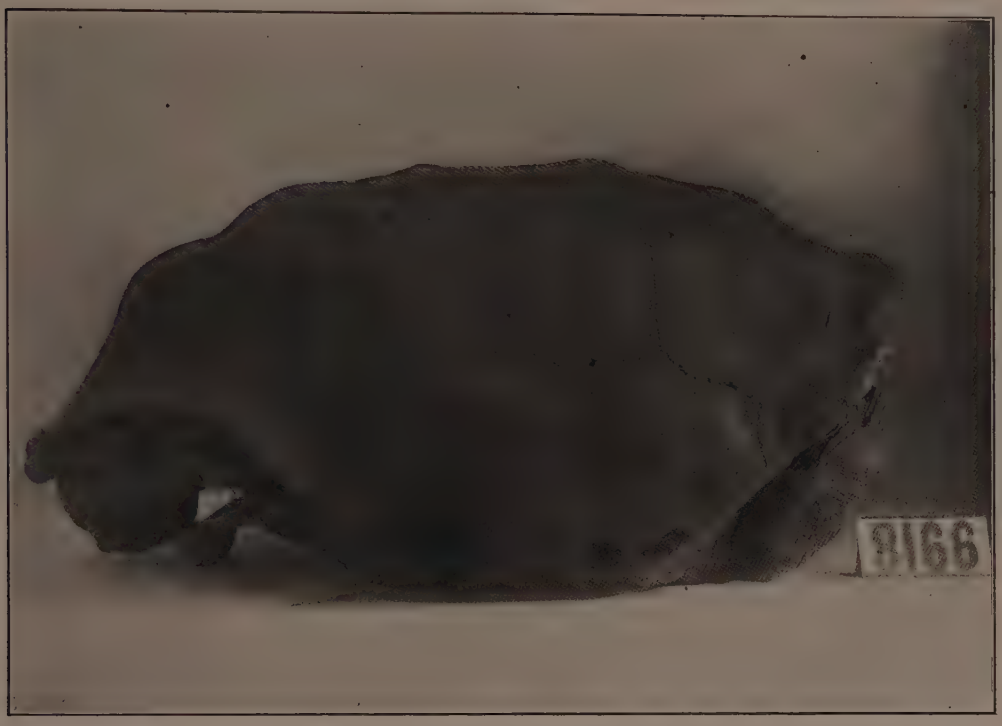


Fig. 1. Testudo microphyes Günther.
Tagus Cove, Albemarle Island. 36 inch male. From side.

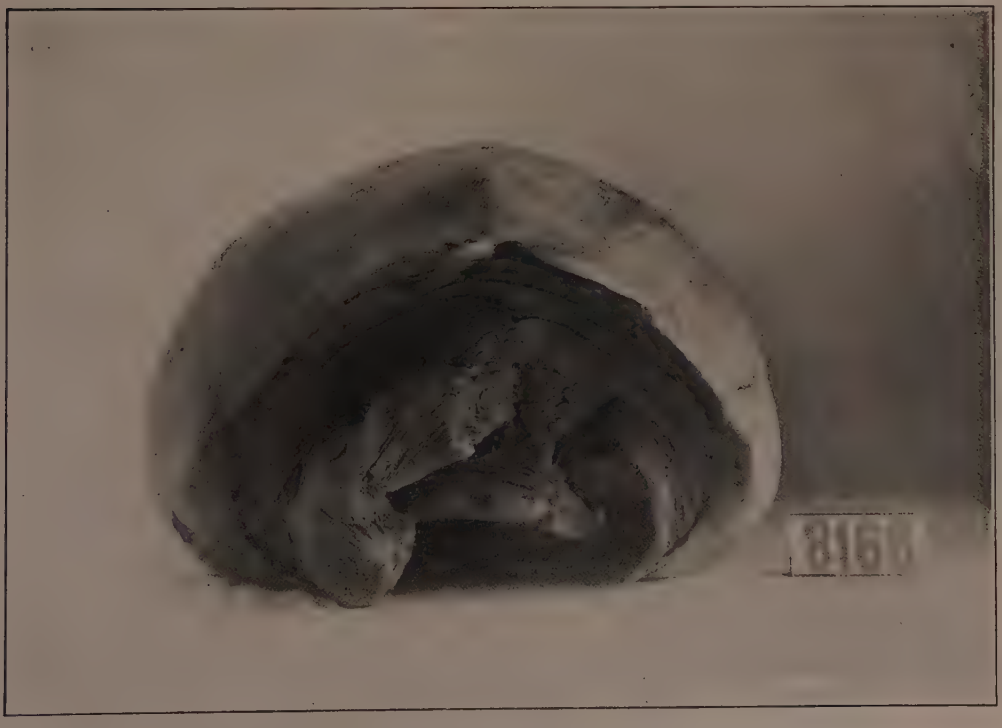


Fig. 2. Testudo microphyes Günther.
Tagus Cove, Albemarle Island. 36 inch male. From in front.

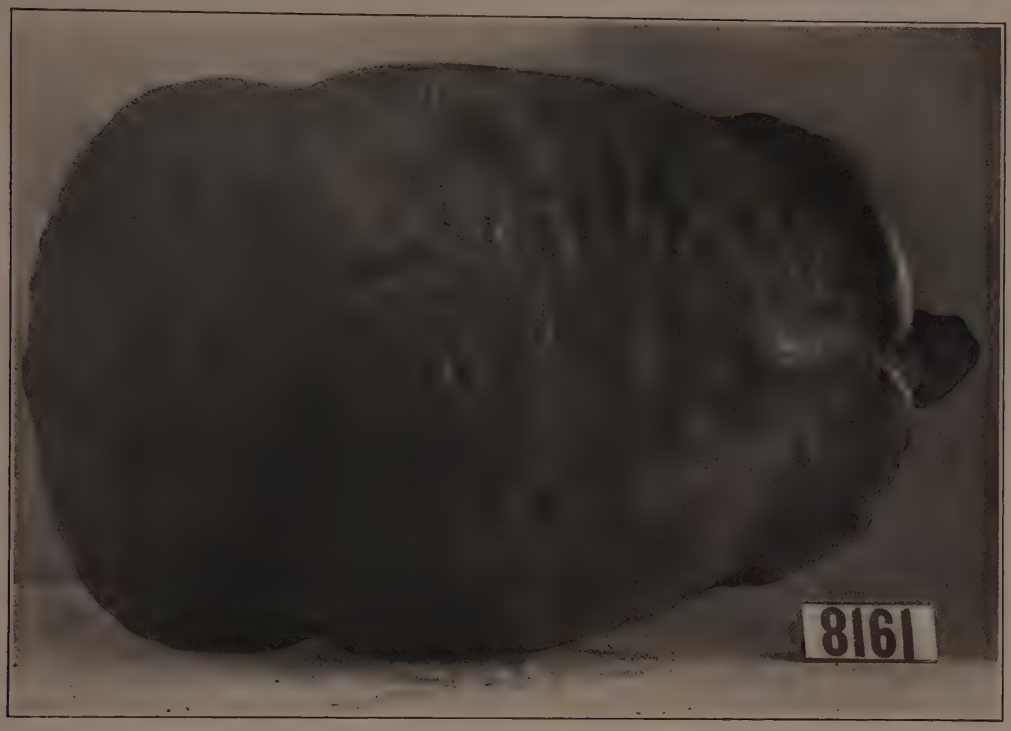


Fig. 1. Testudo microphyes Günther.
Tagus Cove, Albemarle Island. 34.5 inch male. From above.

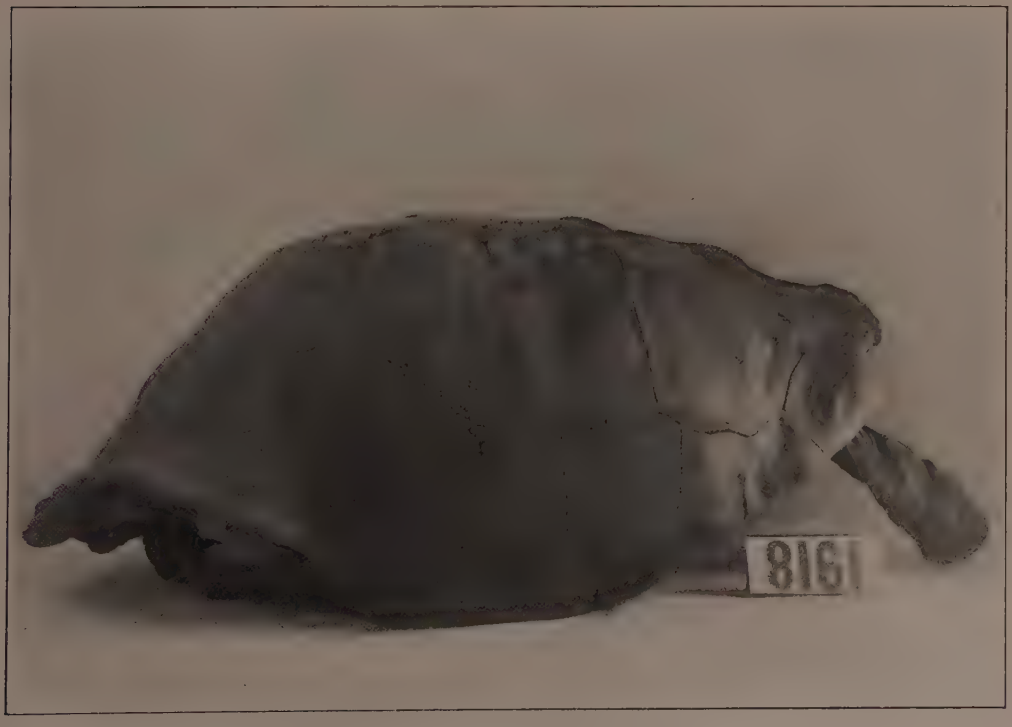


Fig. 2. Testudo microphyes Günther.
Tagus Cove, Albemarle Island. 34.5 inch male. From side.

Fig. 1. Testudo microphyes Günther.
Tagus Cove, Albemarle Island. 34.5 inch male. From in front.

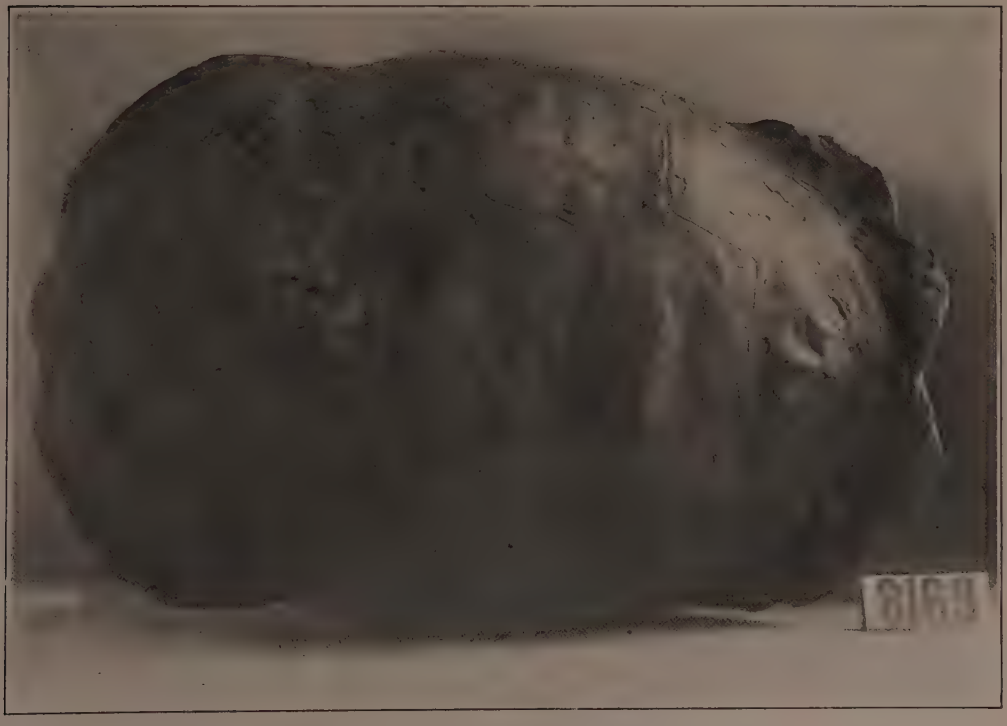

Fig. 2. Testudo microphyes Günther.
Cape Rose, Albemarle Island. 38 inch male. From above.

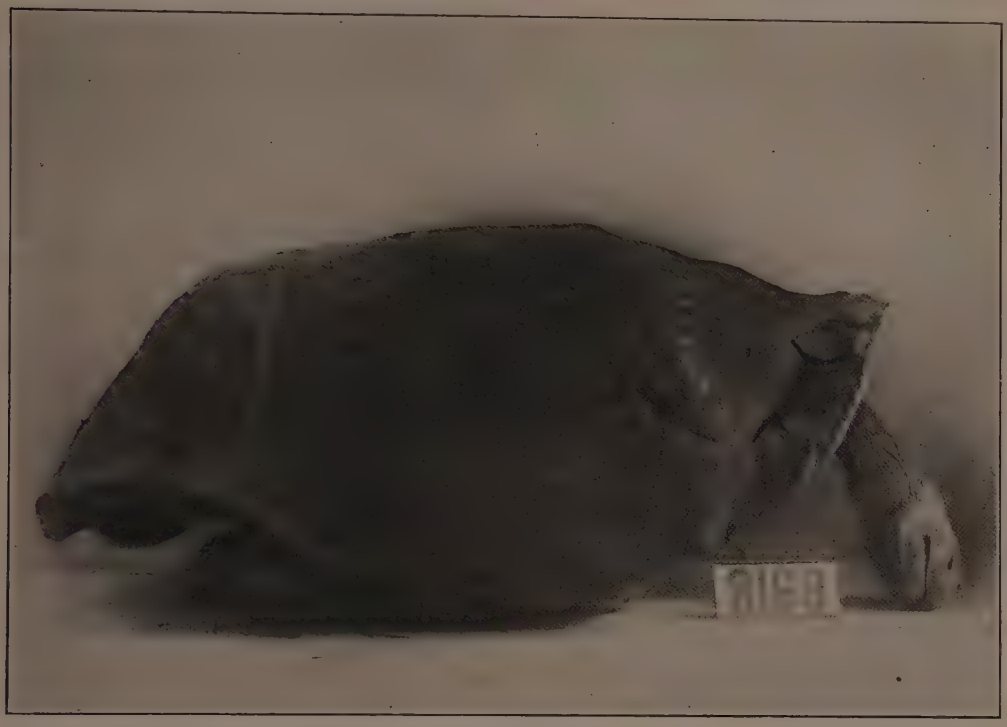

Fig. 1. Testudo microphyes Günther.
Cape Rose, Albemarle Island. 38 inch male. From side.

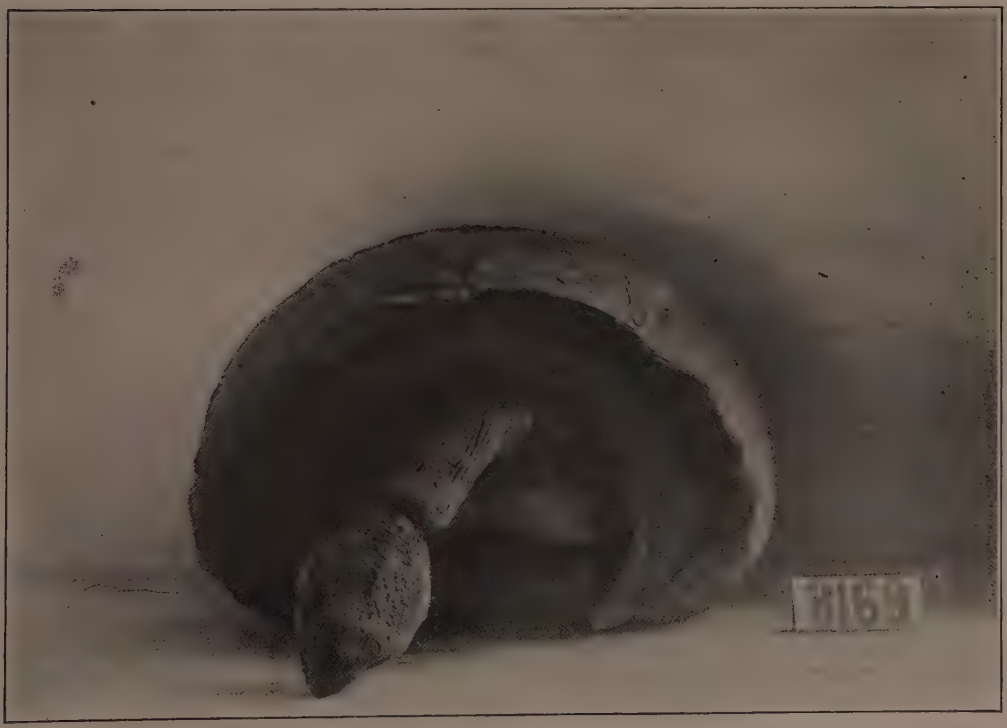

Fig. 2. Testudo microphyes Günther.
Cape Rose, Albemarle Island. 38 inch male. From in front.

Fig. 1. Testudo microphyes Günther.
Cape Rose, Albemarle Island. 35.25 inch male. From above.

Fig. 2. Testudo microphyes Günther.
Cape Rose, Albemarle Island. 35.25 inch male. From side.

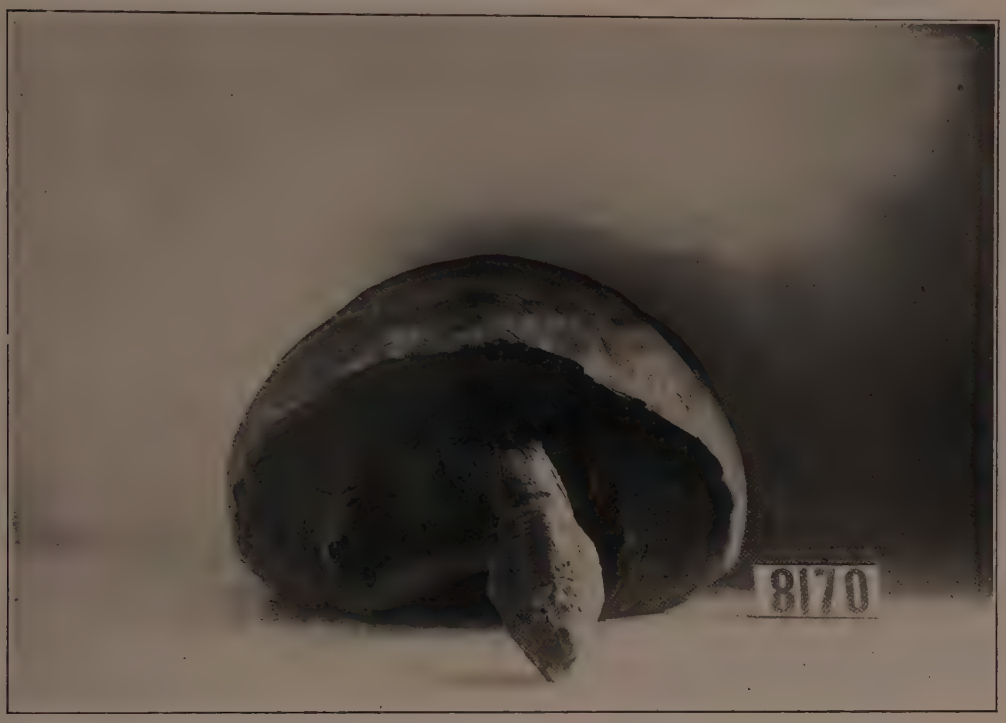


Fig. 1. Testudo microphyes Günther.
Cape Rose, Albemarle Island. 35.25 inch male. From in front.

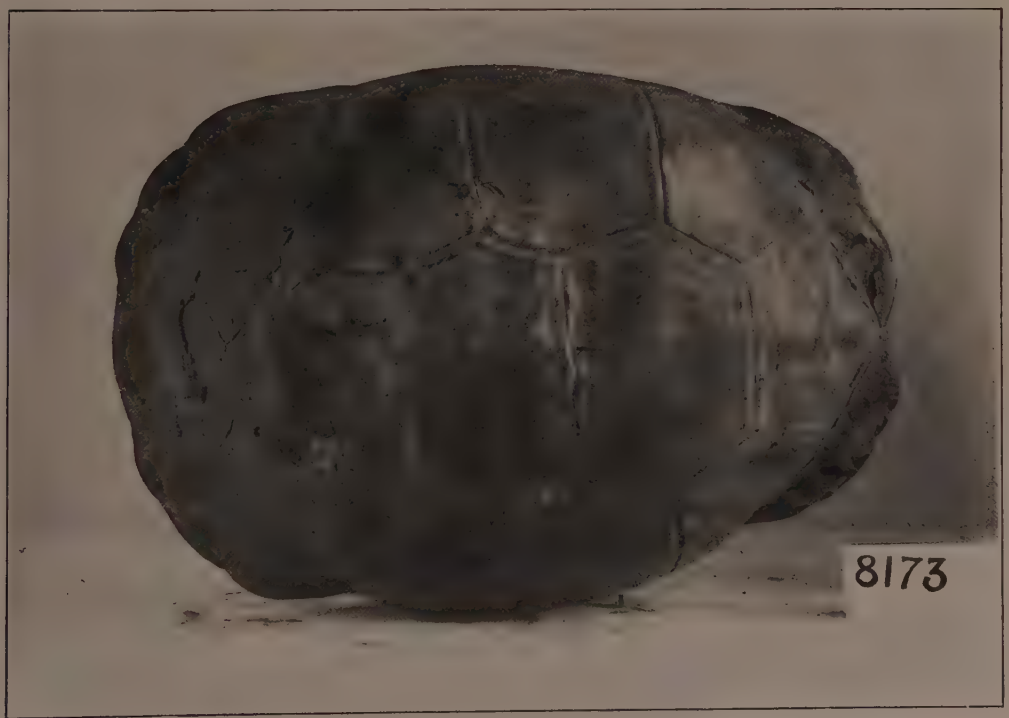


Fig. 2. Testudo microphyes Günther.
Cape Rose, Albemarle Island. 25 inch female. From above.

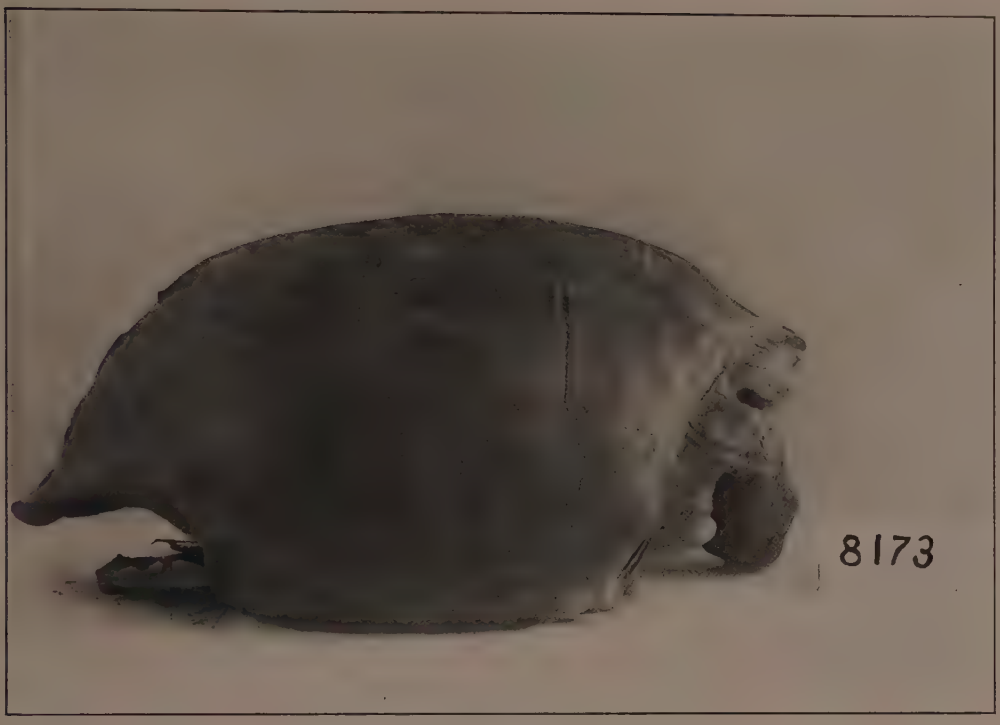


Fig. 1. Testudo microphyes Günther.
Cape Rose, Albemarle Island. 25 inch female. From side.

Fig. 2. Testudo microphyes Günther.
Cape Rose, Albemarle Island. 25 inch female. From in front.

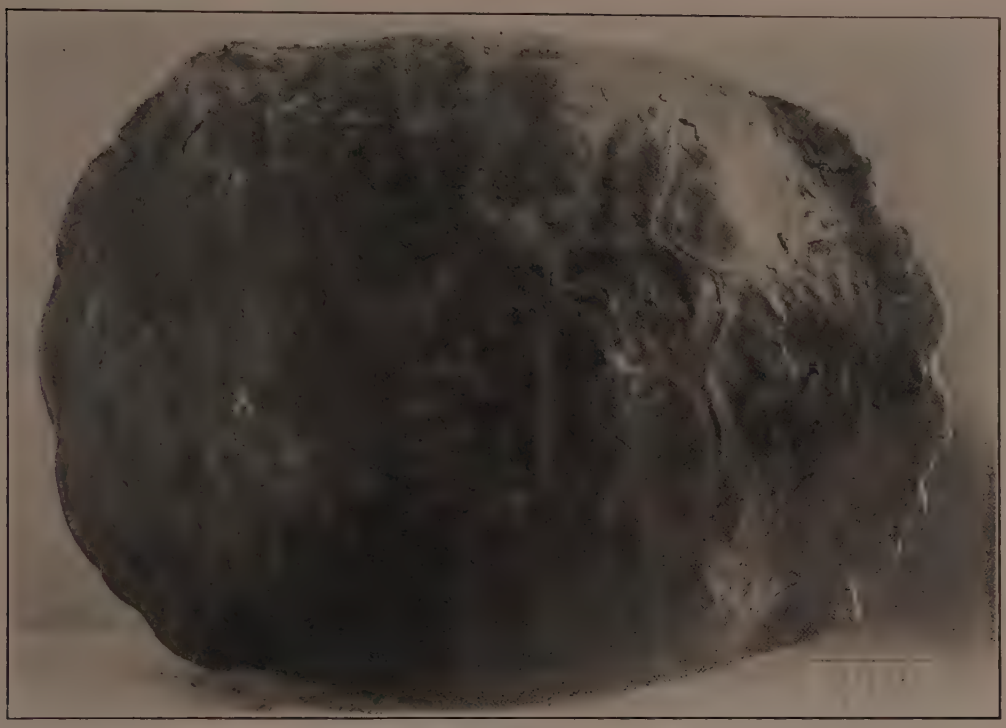

Fig. 1. Testudo güntheri Baur.
Vilamil, Albemarle. 40 inch male. From above.

Fig. 2. Testudo güntheri Baur.
Vilamil, Albemarle. 40 inch male. From side.

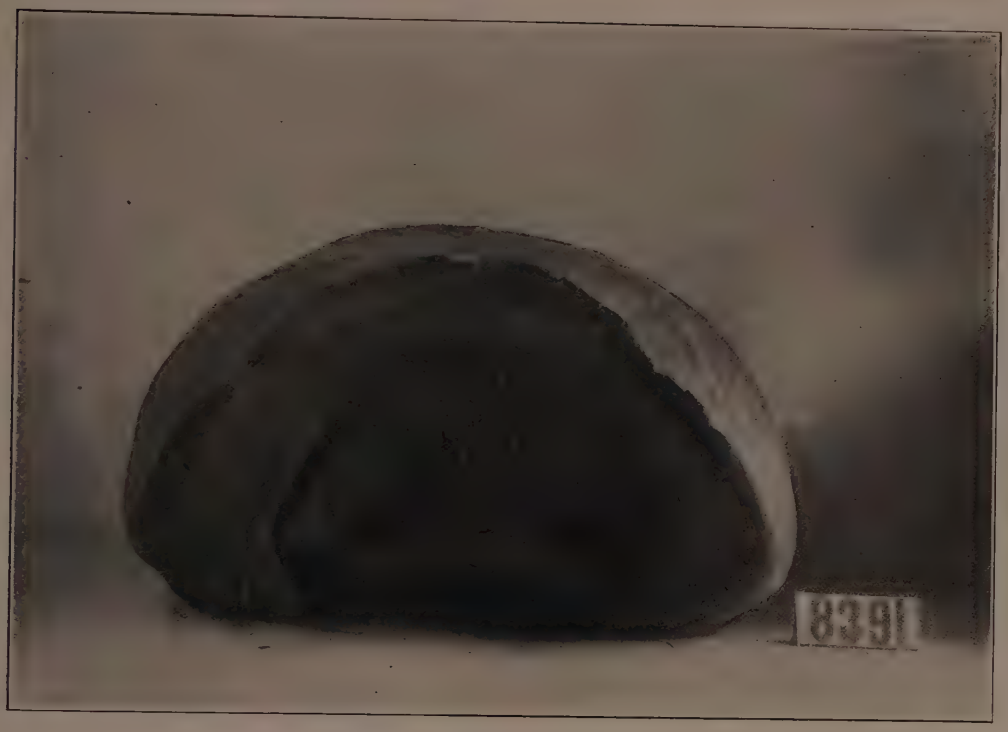


Fig. 1. Testudo güntheri Baur.
Vilamil, Albemarle. 40 inch male. From in front.

Fig. 2. Testudo güntheri Baur.
Vilamil, Albemarle. 39 inch male. From above.

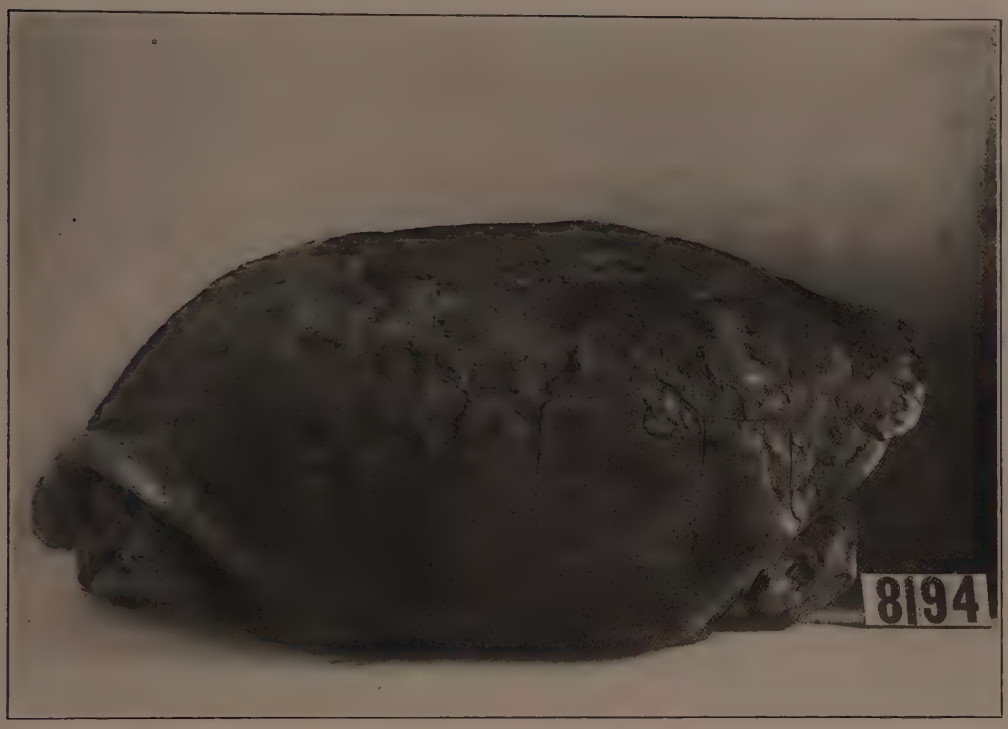


Fig. 1. Testudo güntheri Baur.
Vilamil, Albemarle. 39 inch male. From side.

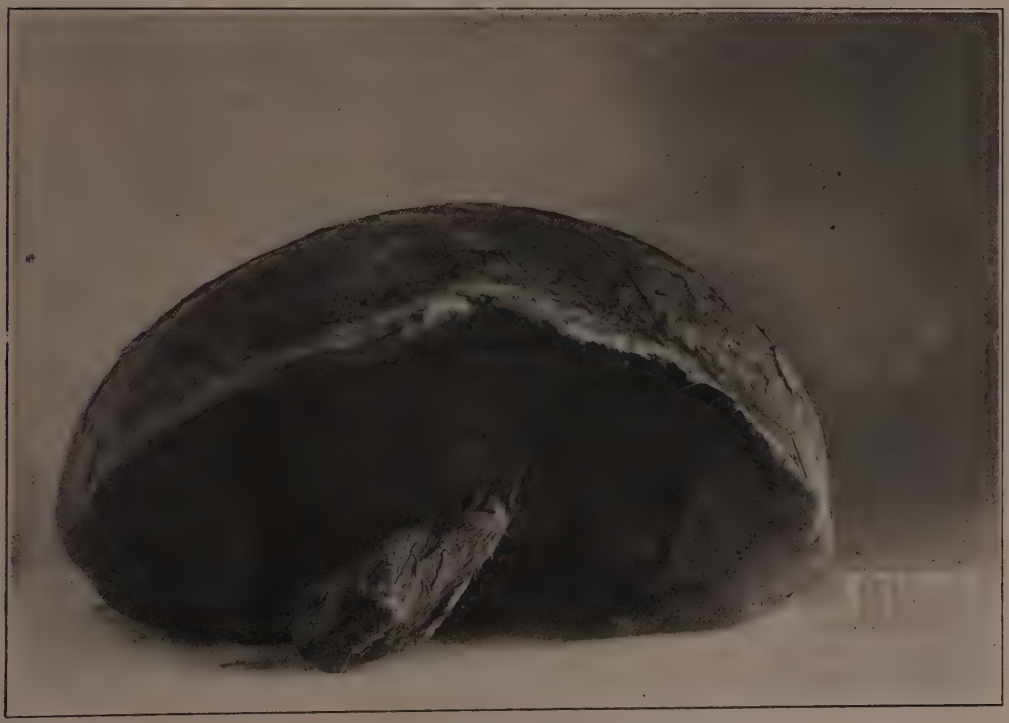

Fig. 2. Testudo güntheri Baur.
Vilamil, Albemarle. 39 inch male. From in front.

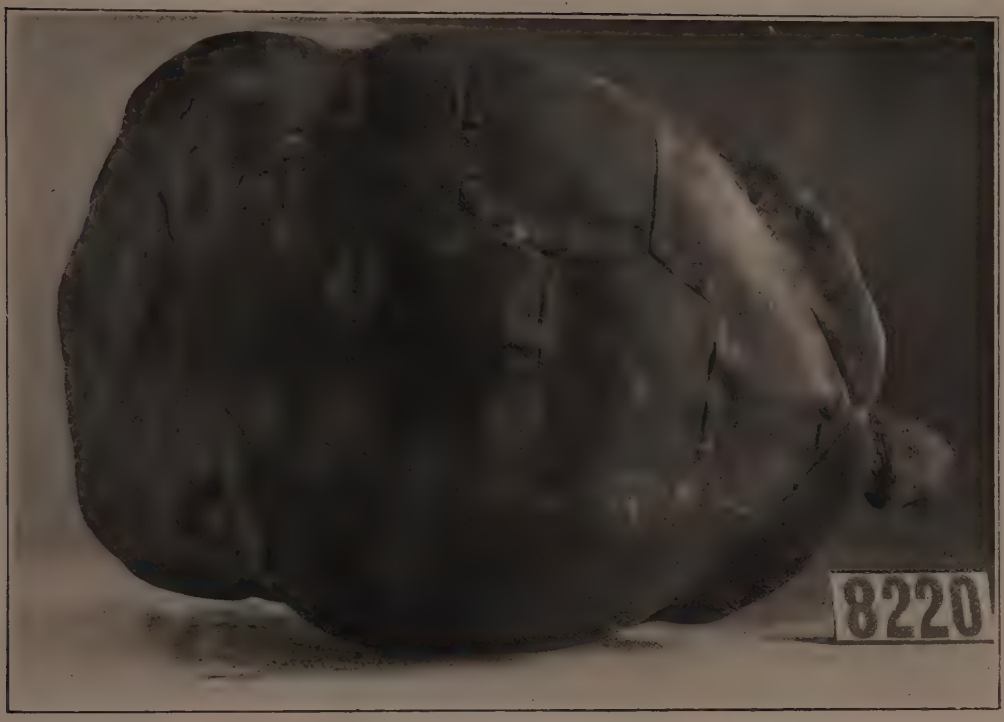


Fig. 1. Testudo güntheri Baur.
Vilamil, Albemarle Island. 28 inch male. From above.

Fig. 2. Testudo güntheri Baur.
Vilamil, Albemarle Island. 28 inch male. From side

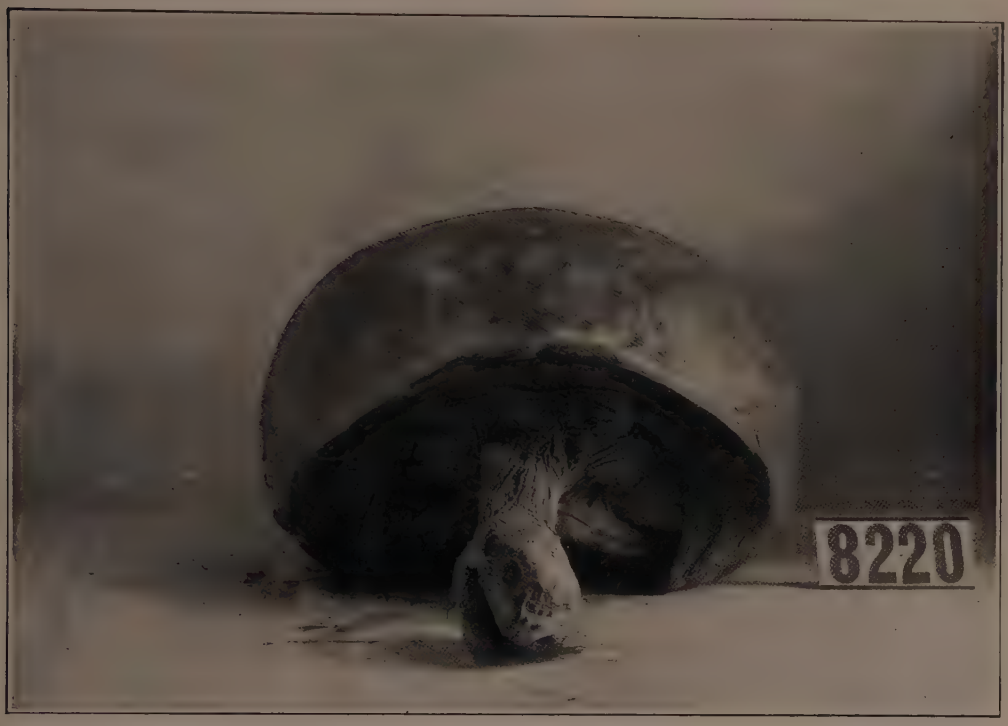


Fig. 1. Testudo güntheri Baur.
Vilamil, Albemarle Island. 28 inch male. From in front.

Fig. 2. Testudo güntheri Baur.
Vilamil, Albemarle Island. 25.1 inch male. From above.

Fig. 1. Testudo güntheri Baur.
Vilamil, Albemarle Island. 25.1 inch male. From side.

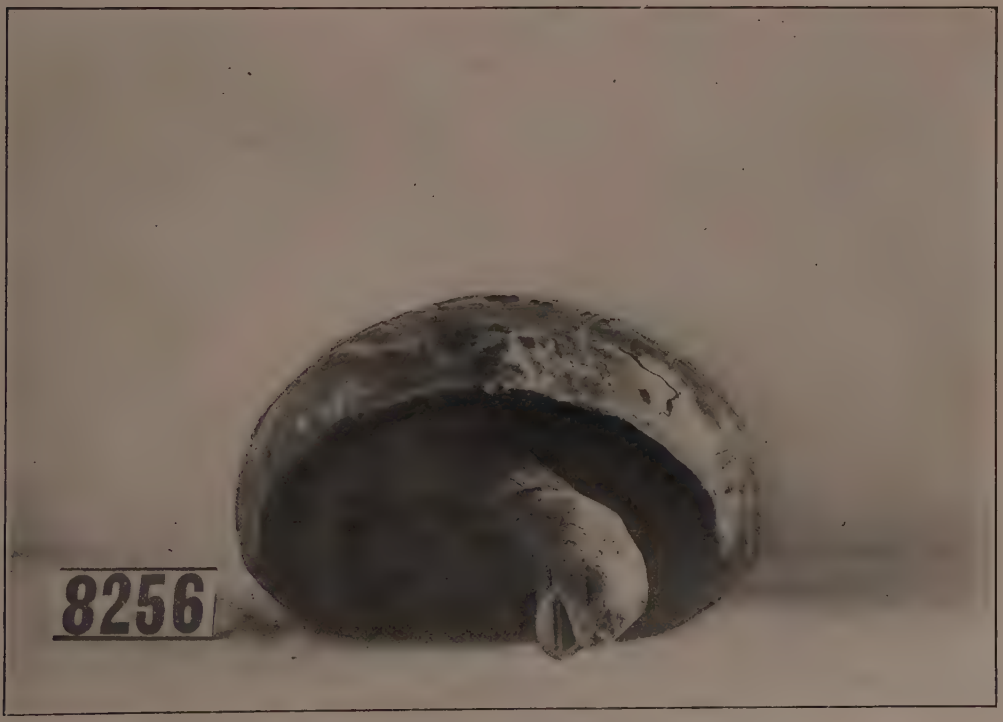


Fig. 2. Testudo güntheri Baur.
Vilamil, Albemarle Island. 25.1 inch male. From in front.

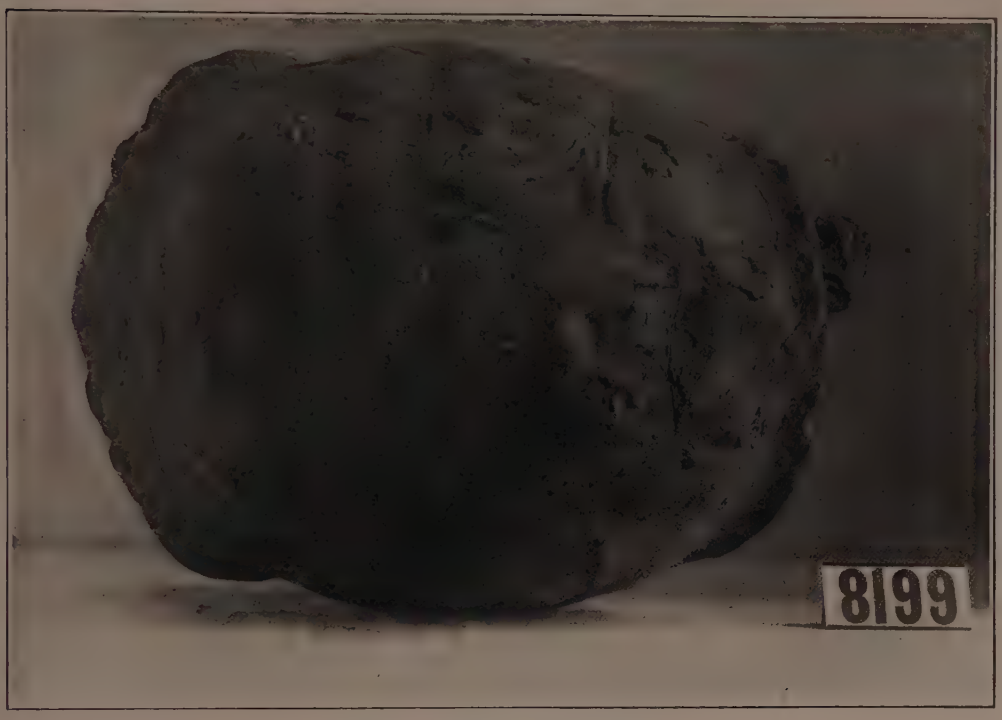


Fig. 1. Testudo güntheri Baur.
Vilamil, Albemarle Island. 28.8 inch female. From above.

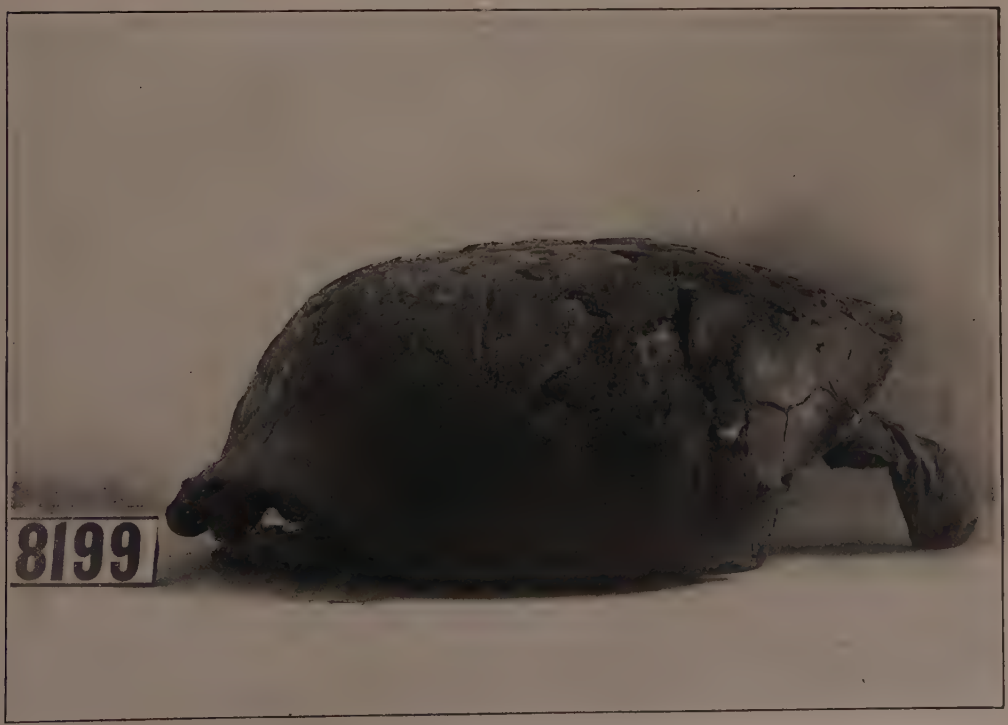


Fig. 2. Testudo güntheri Baur.
Vilamil, Albemarle Island. 28.8 inch female. From side.

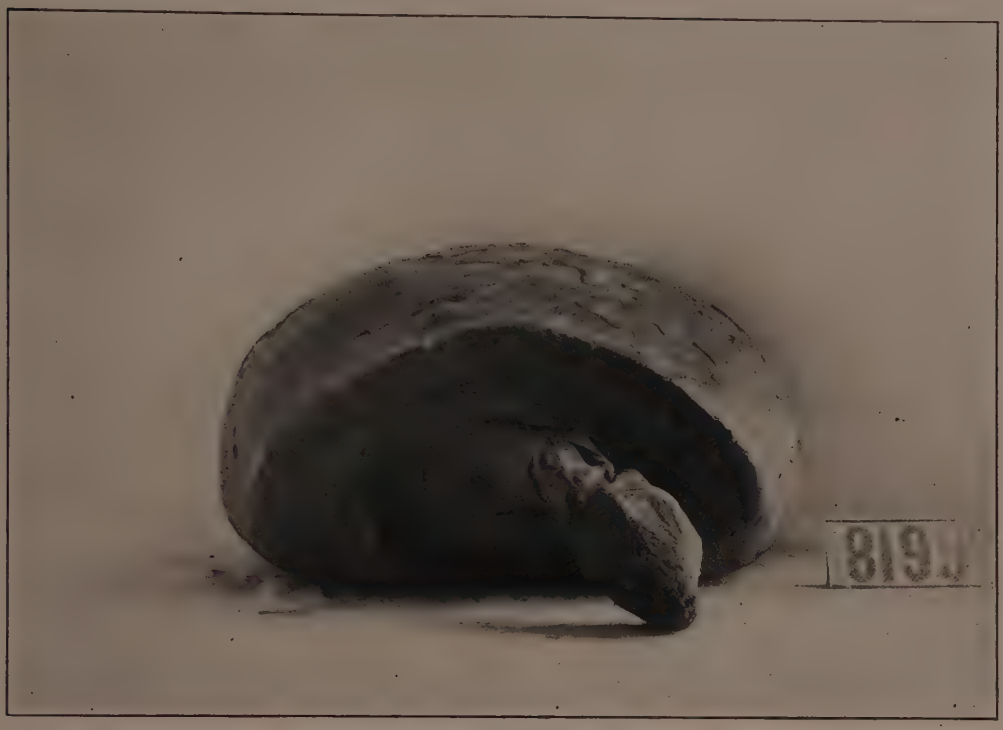


Fig. 1. Testudo güntheri Baur.
Vilamil, Albemarle Island. 28.8 inch female. From in front.

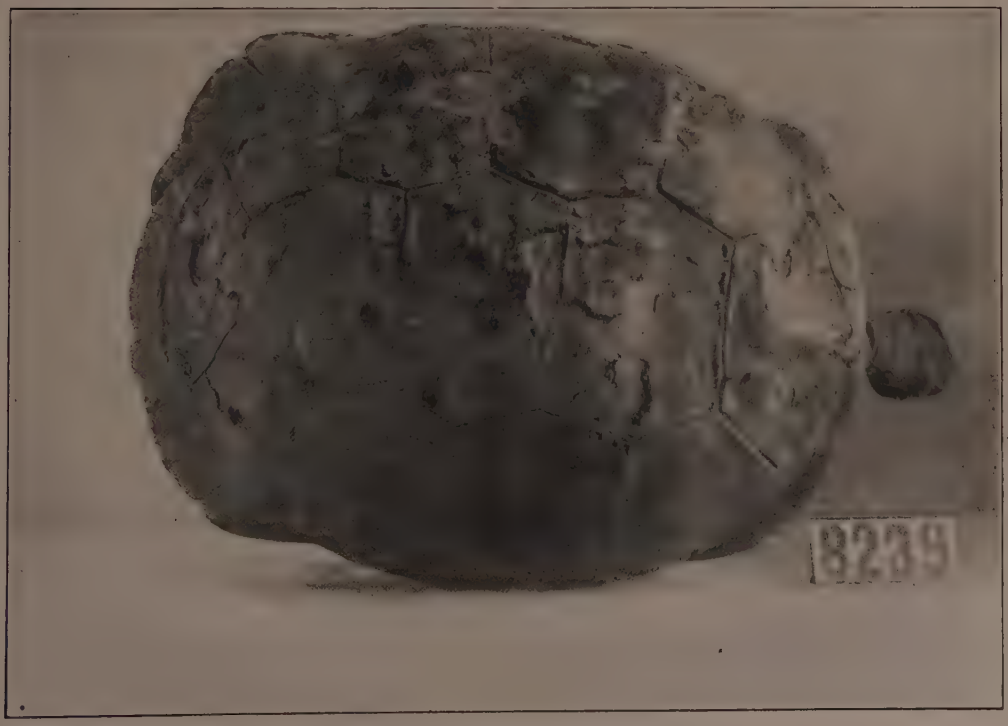


Fig. 2. Testudo güntheri Baur.
Vilamil, Albemarle Island. 27.9 inch female. From above.

Fig. 1. Testudo güntheri Baur.
Vilamil, Albemarle Island. 27.9 inch female. From side.

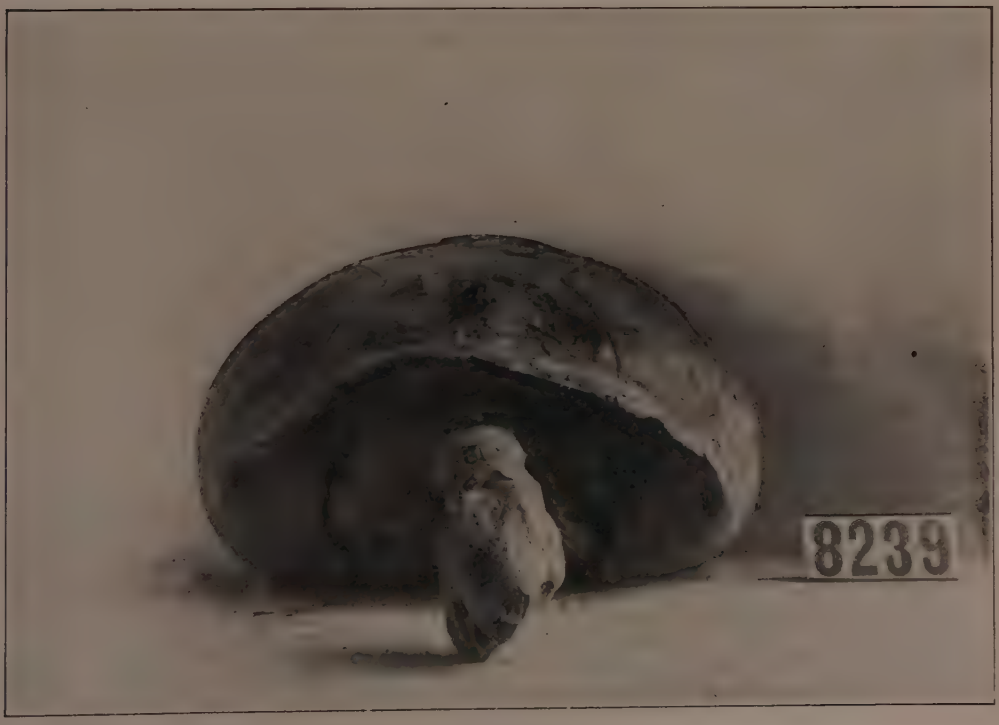


Fig. 2. Testudo güntheri Baur.
Vilamil, Albemarle Island. 27.9 inch female. From in front.

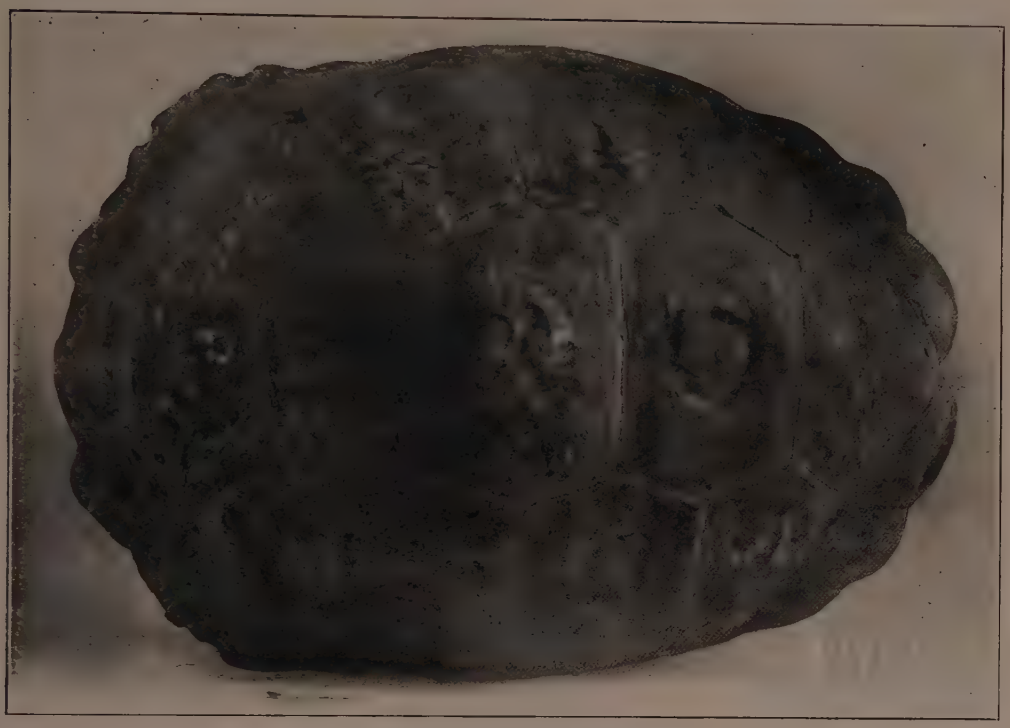

Fig. 1. Testudo vicina Günther.
Iguana Cove, Albemarle Island. 43 inch male. From above.

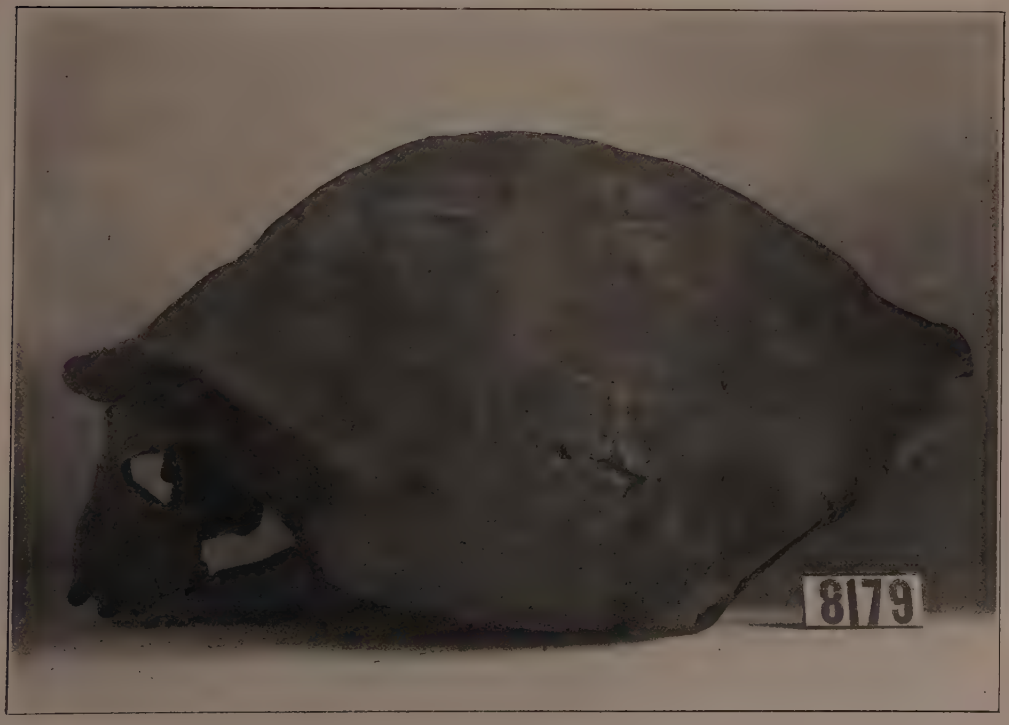


Fig. 2. Testudo vicina Günther.
Iguana Cove, Albemarle Island. 43 inch male. From side.

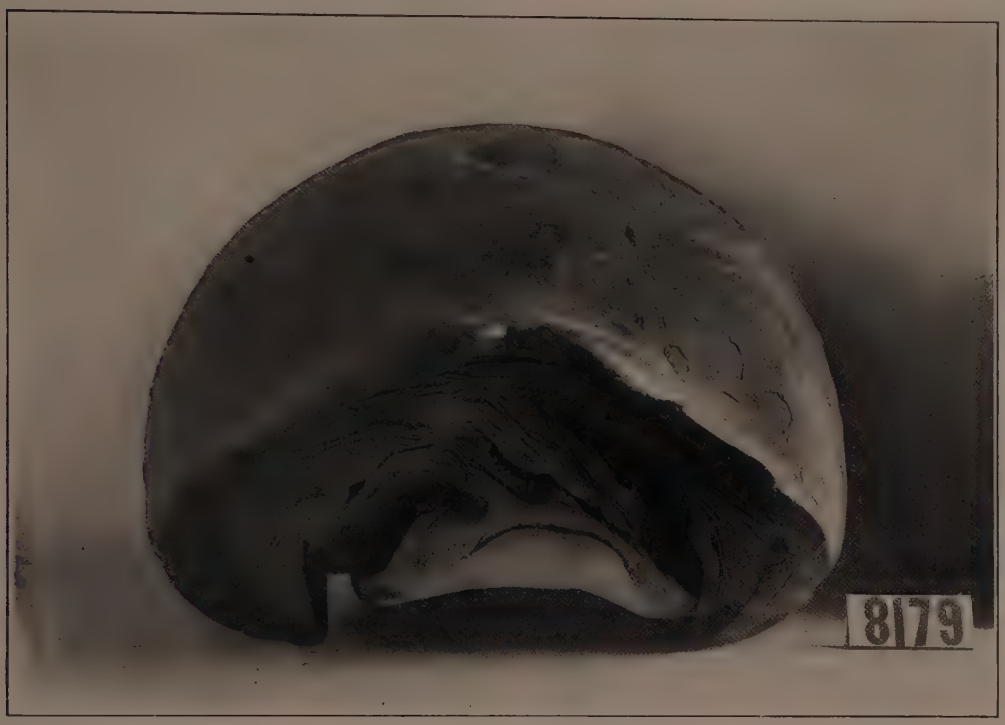


Fig. 1. Testudo vicina Günther.
Iguana Cove, Albemarle Island. 43 inch male. From in front.

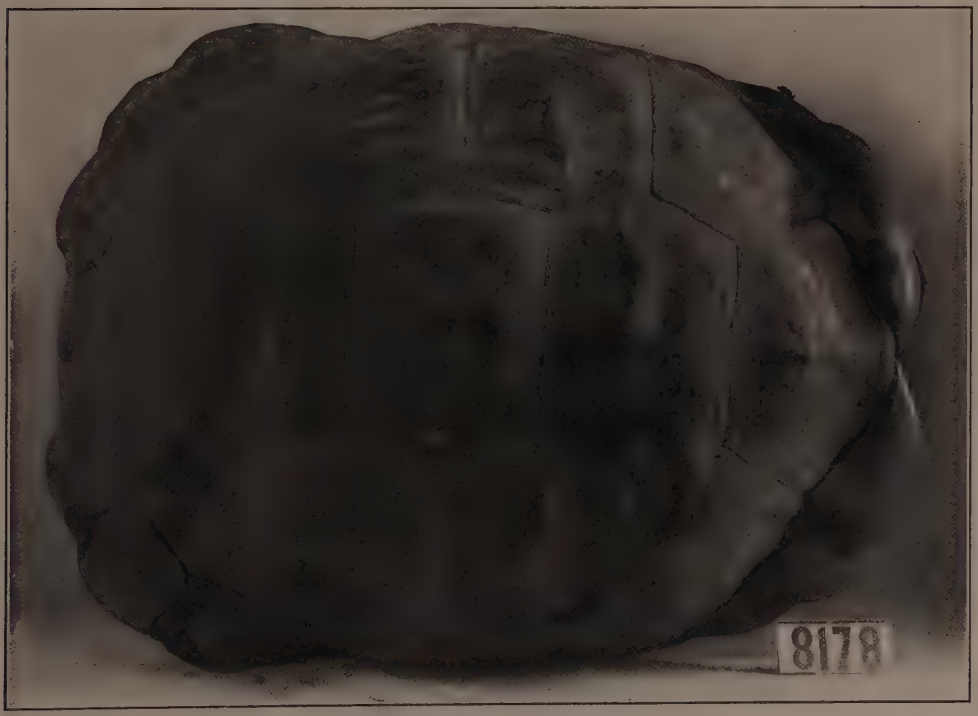


Fig. 2. Testudo vicina Günther.
Iguana Cove, Albemarle Island. 41 inch male. From above.

Fig. 1. Testudo vicina Günther.
Iguana Cove, Albemarle Island. 41 inch male. From side.

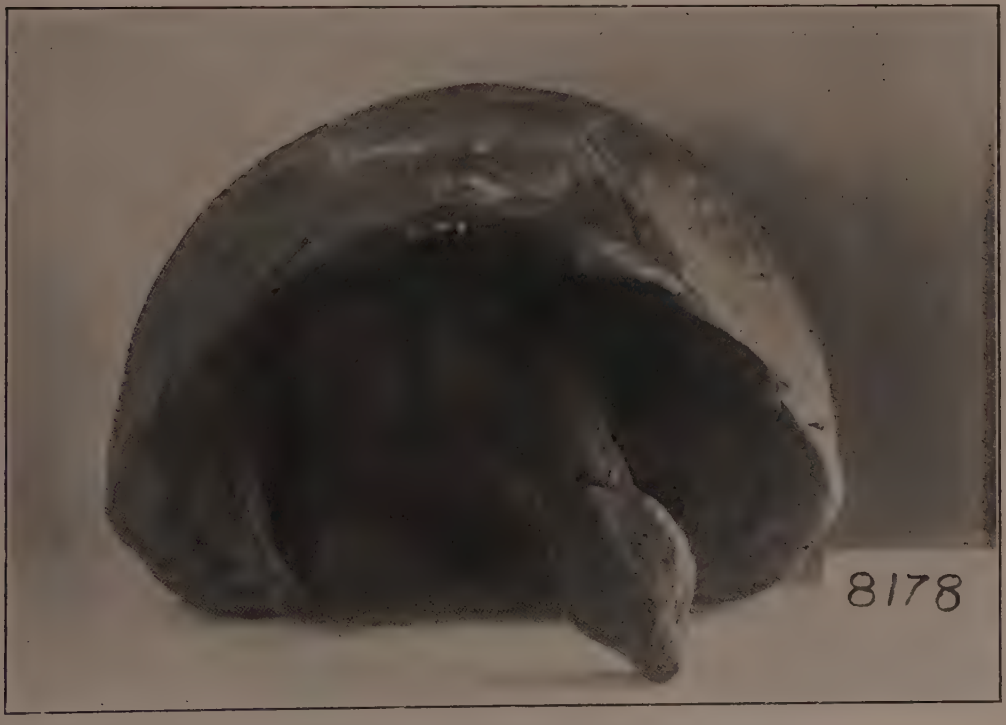


Fig. 2. Testudo vicina Günther.
Iguana Cove, Albemarle Island. 41 inch male. From in front.

Fig. 1. Testudo vicina Günther.
Iguana Cove, Albemarle Island. 38.5 inch male. From above.

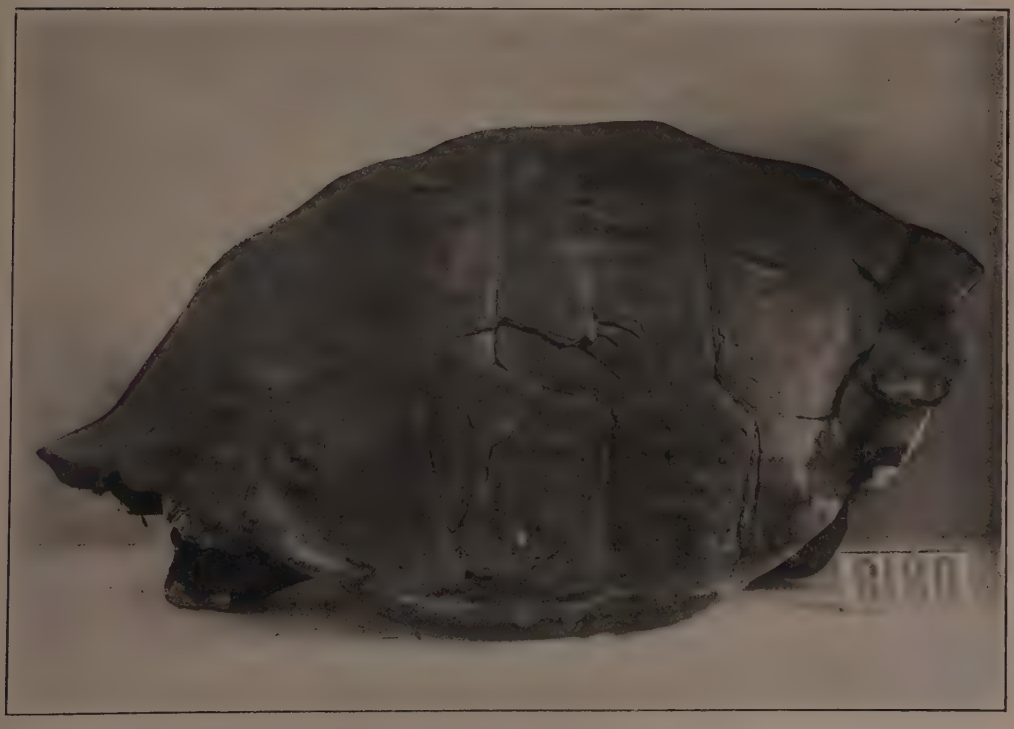

Fig. 2. Testudo vicina Günther.
Iguana Cove, Albemarle Island. 38.5 inch male. From side.

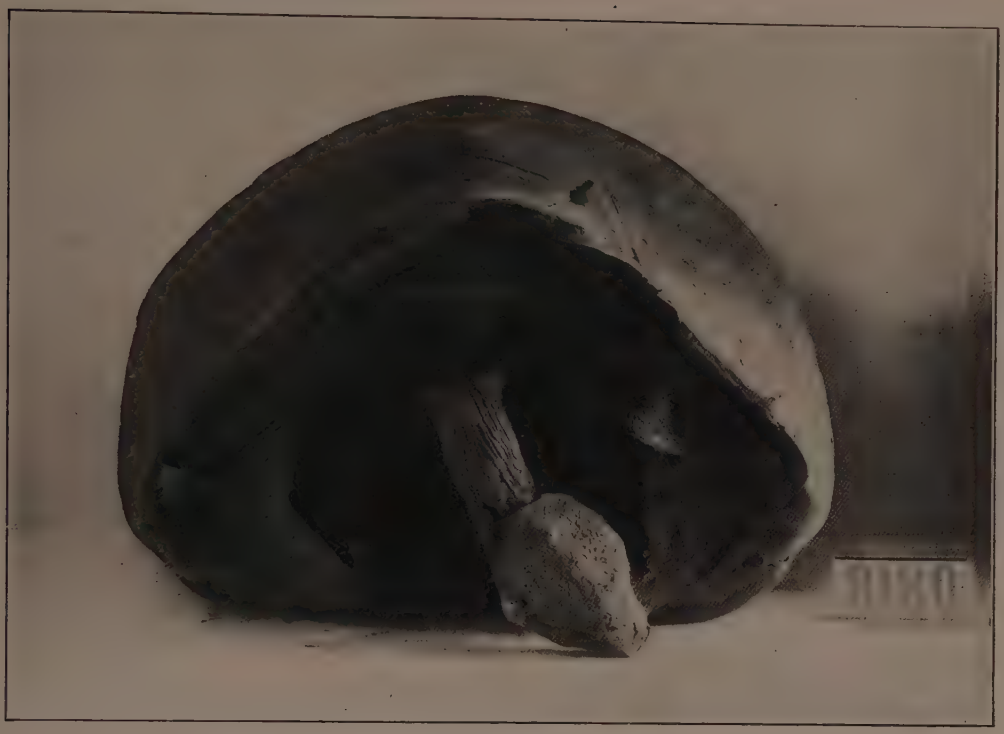

Fig. 1. Testudo vicina Günther.
Iguana Cove, Albemarle Island. 38.5 inch male. From in front.

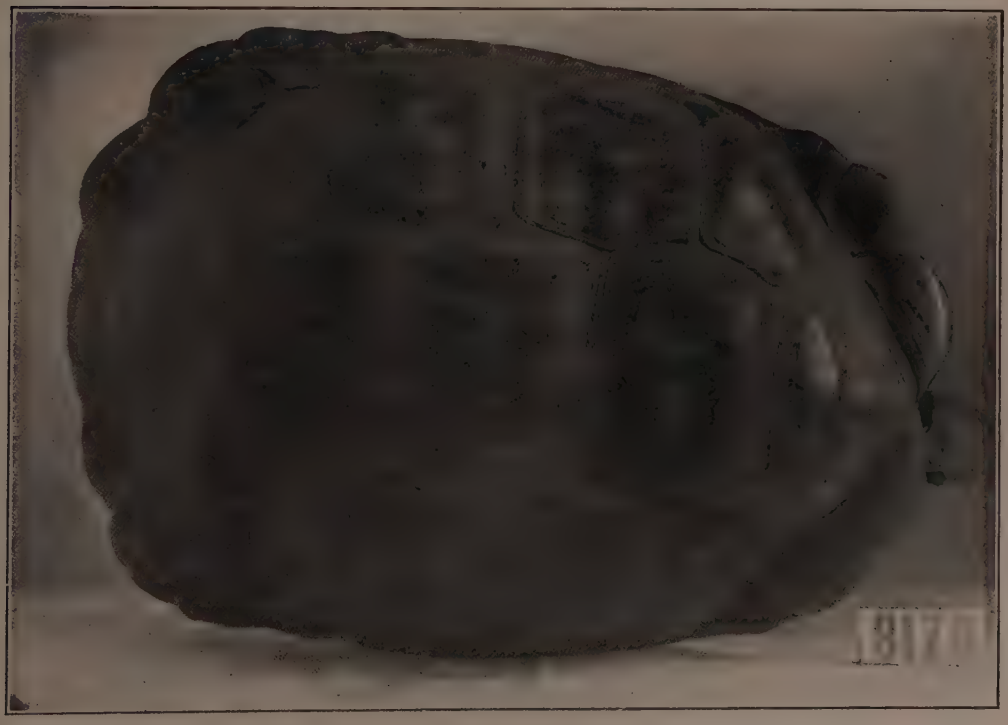

Fig. 2. Testudo vicina Günther.
Iguana Cove, Albemarle Island. 37.2 inch male. From above.

Fig. 1. Testudo vicina Günther.
Iguana Cove, Albemarle Island. 37.2 inch male. From side.

Fig. 2. Testudo vicina Günther.
Iguana Cove, Albemarle Island. 37.2 inch male. From in front.

Fig. 1. Testudo vicina Günther.
Iguana Cove, Albemarle Island. 35.25 inch male. From above.

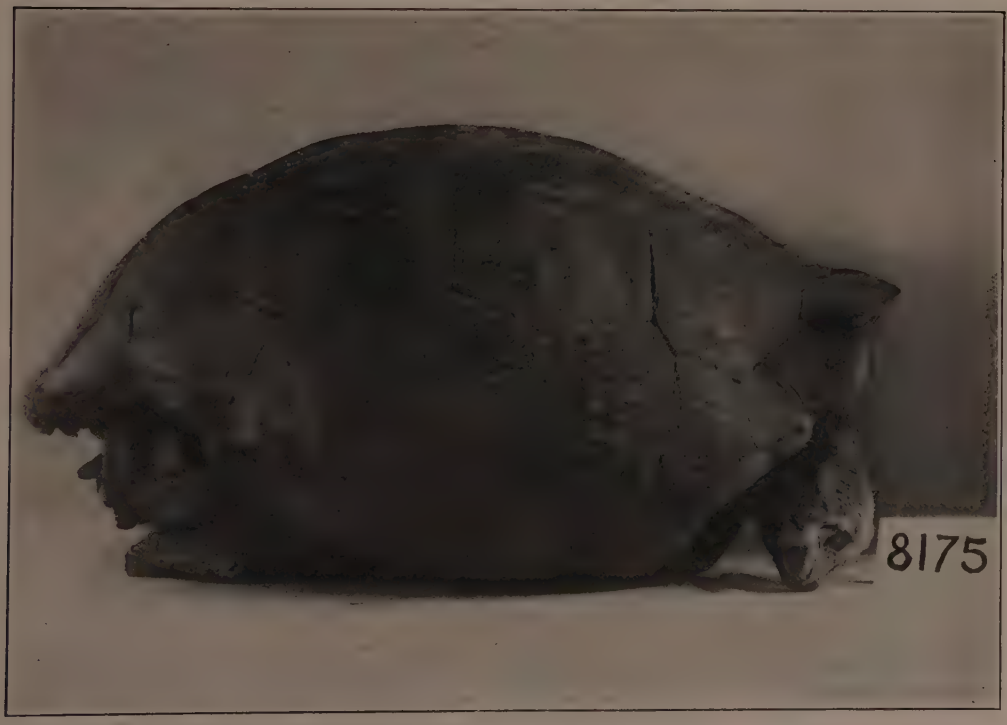


Fig. 2. Testudo vicina Günther.
Iguana Cove, Albemarle Island. 35.25 inch male. From side.

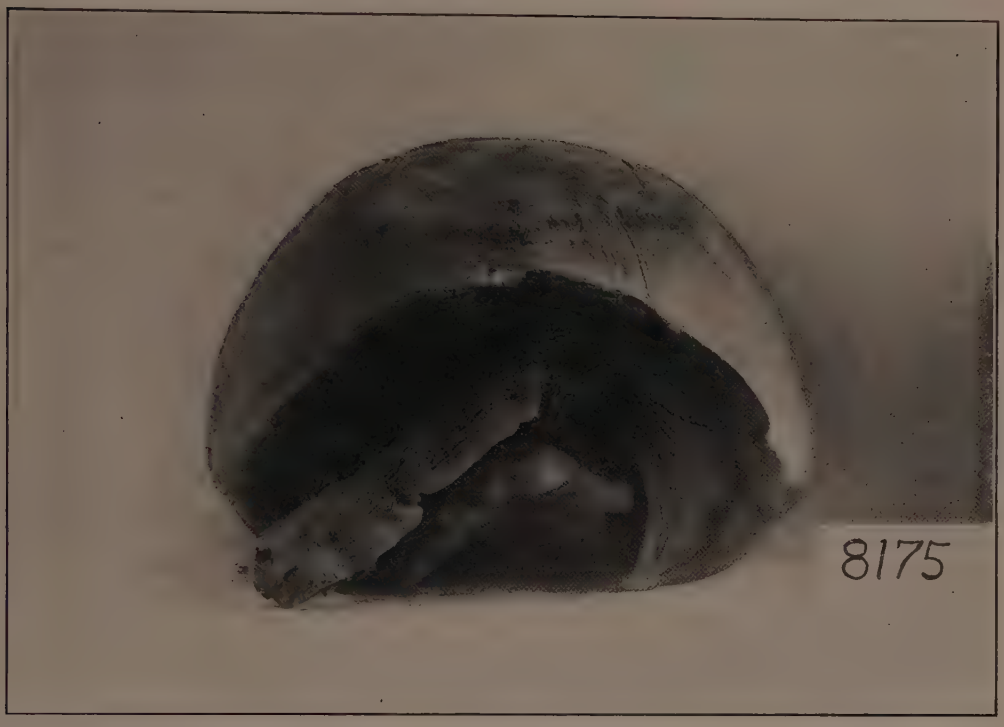


Fig. 1. Testudo vicina Günther.
Iguana Cove, Albemarle Island. 35.25 inch male. From in front.

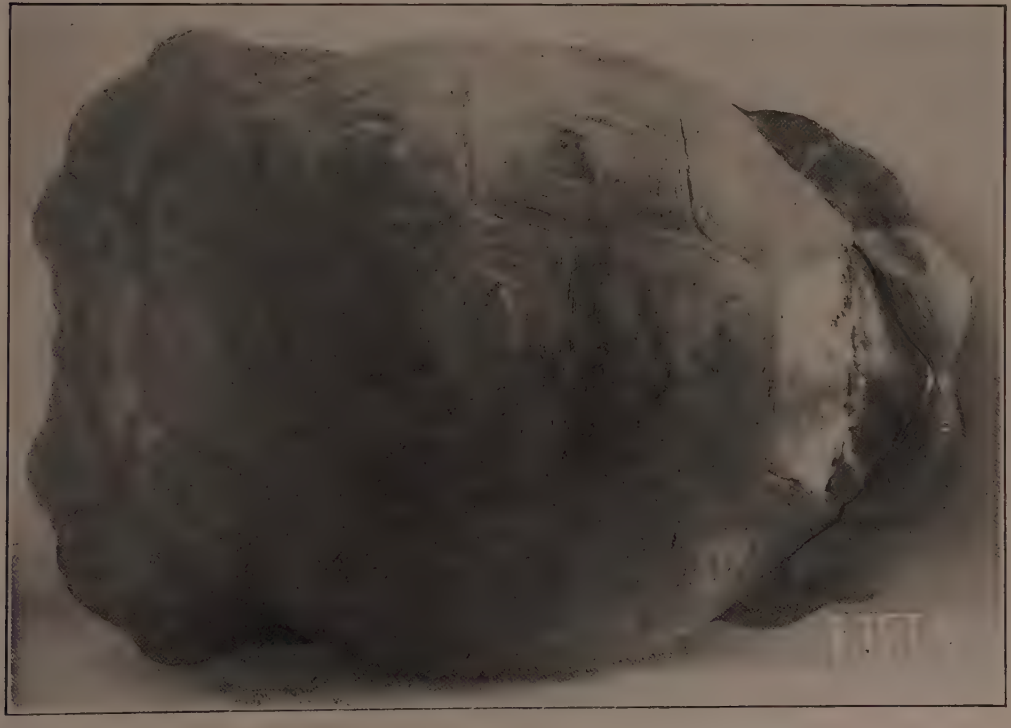

Fig. 2. Testudo vicina Günther.
Cobos Settlement, Albemarle Island. 40.5 inch male. From above.

Fig. 1. Testudo vicina Günther.
Cobos Settlement. Albemarle Island. 40.5 inch male. From side.

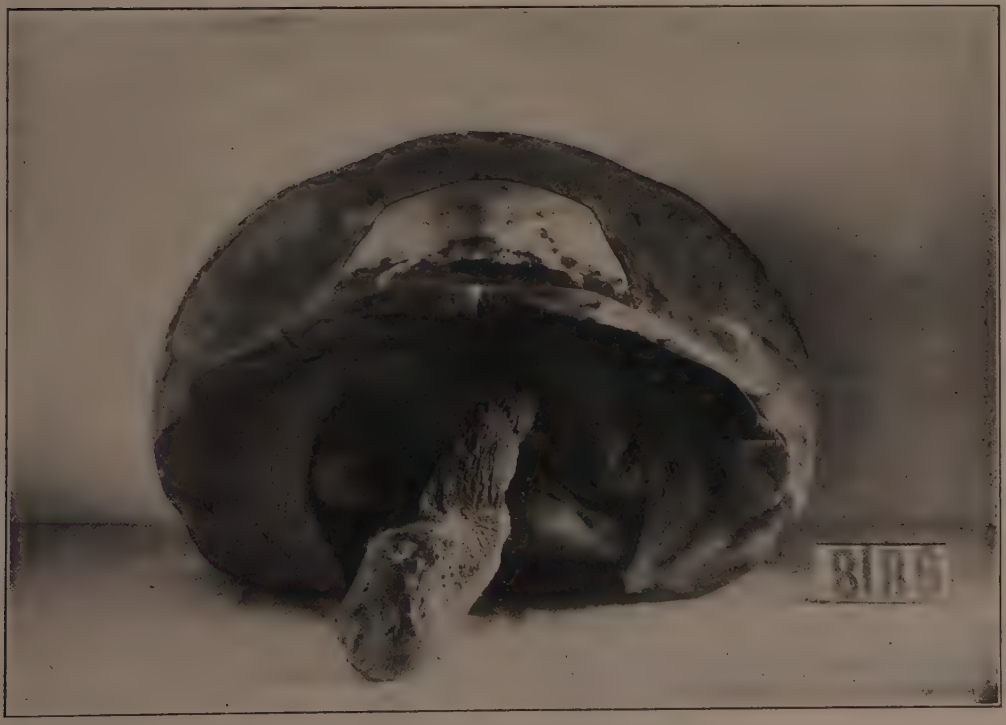


Fig. 2. Testudo vicina Günther.
Cobos Settlement, Albemarle Island. 40.5 inch male. From in front.

Fig. 1. Testudo vicina Günther.
Cobos Settlement, Albemarle Island. 33.3 inch male. From above.

Fig. 2. Testudo vicina Günther.
Cobos Settlement, Albemarle Island. 33.3 inch male. From side.

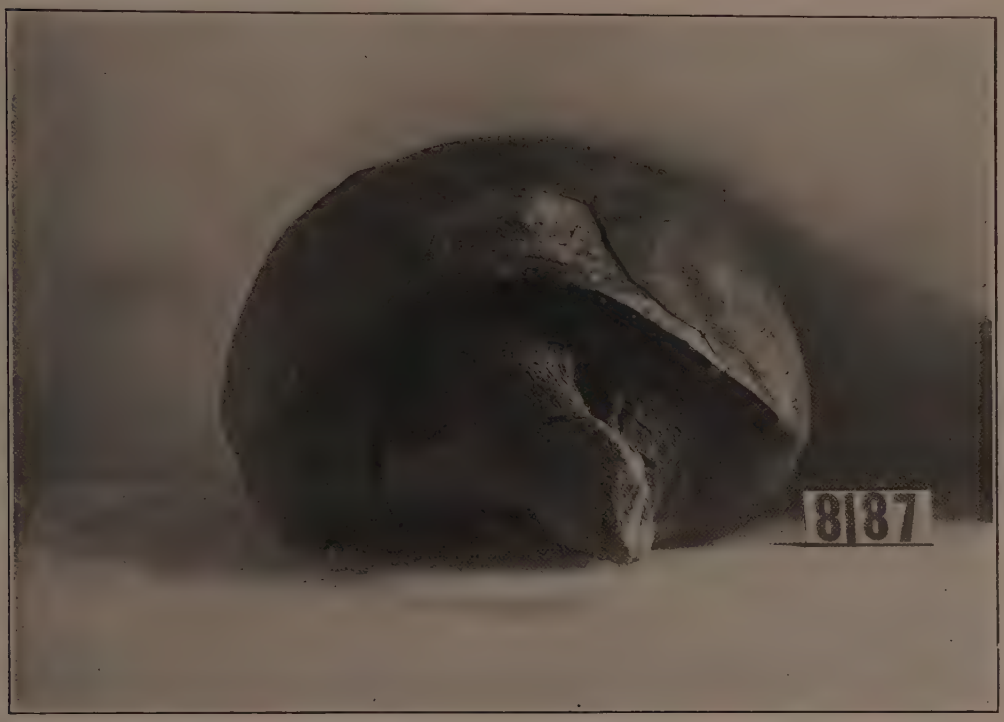


Fig. 1. Testudo vicina Günther.
Cobos Settlement, Albemarle Island. 33.3 inch male. From in front.

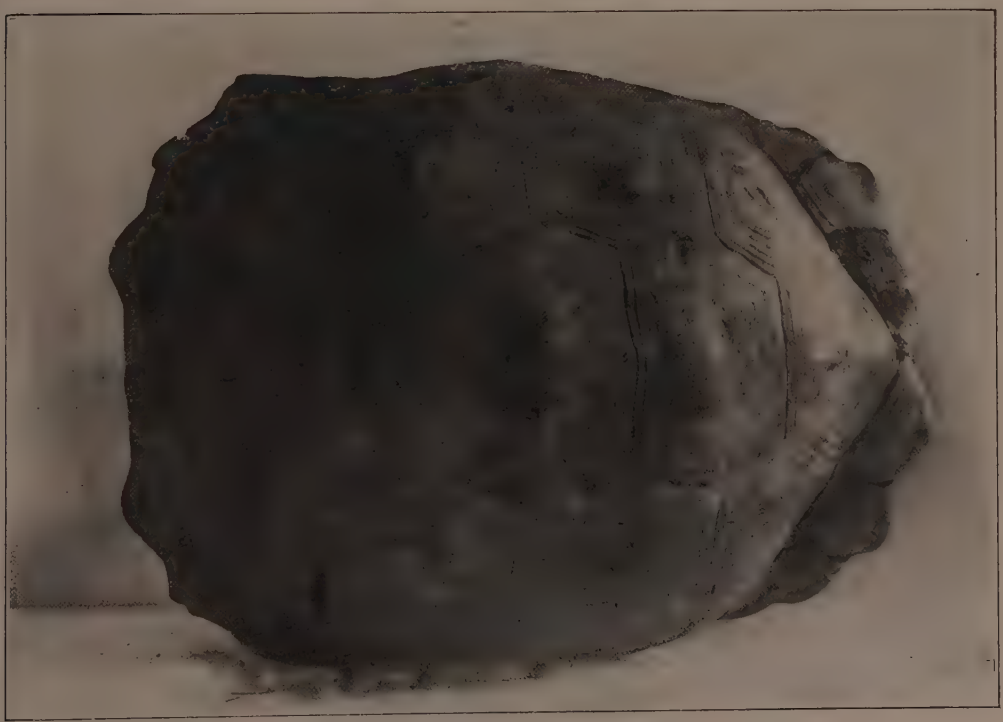

Fig. 2. Testudo vicina Günther.
Vilamil, Albemarle Island. 33 inch male. From above.

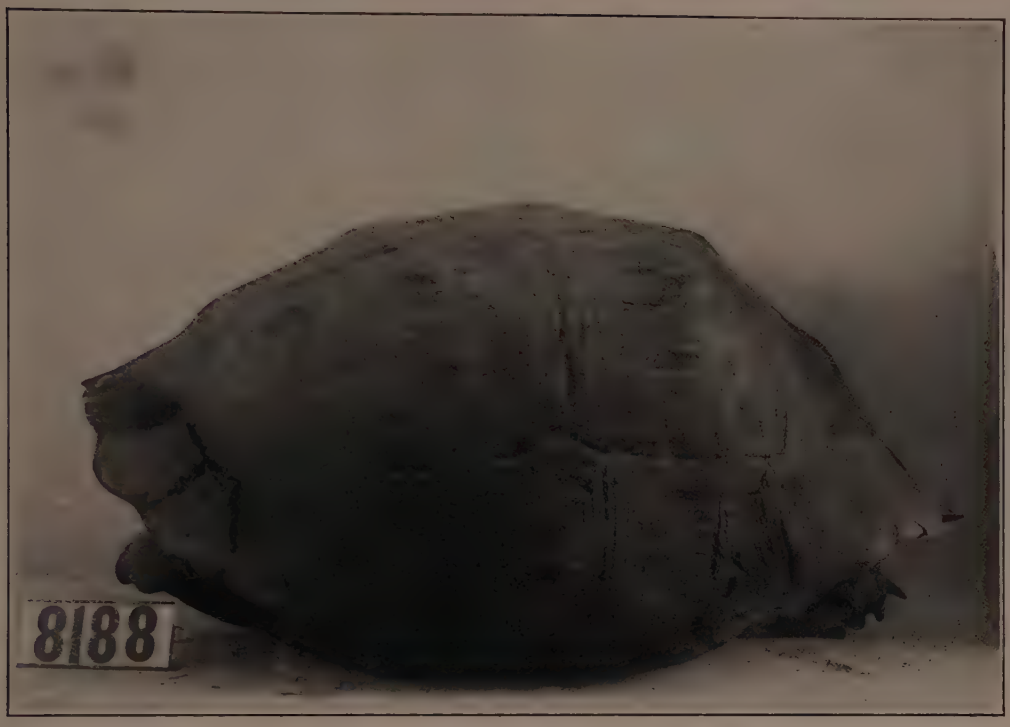


Fig. 1. Testudo vicina Günther.
Vilamil, Albemarle Island. 33 inch male. From side.

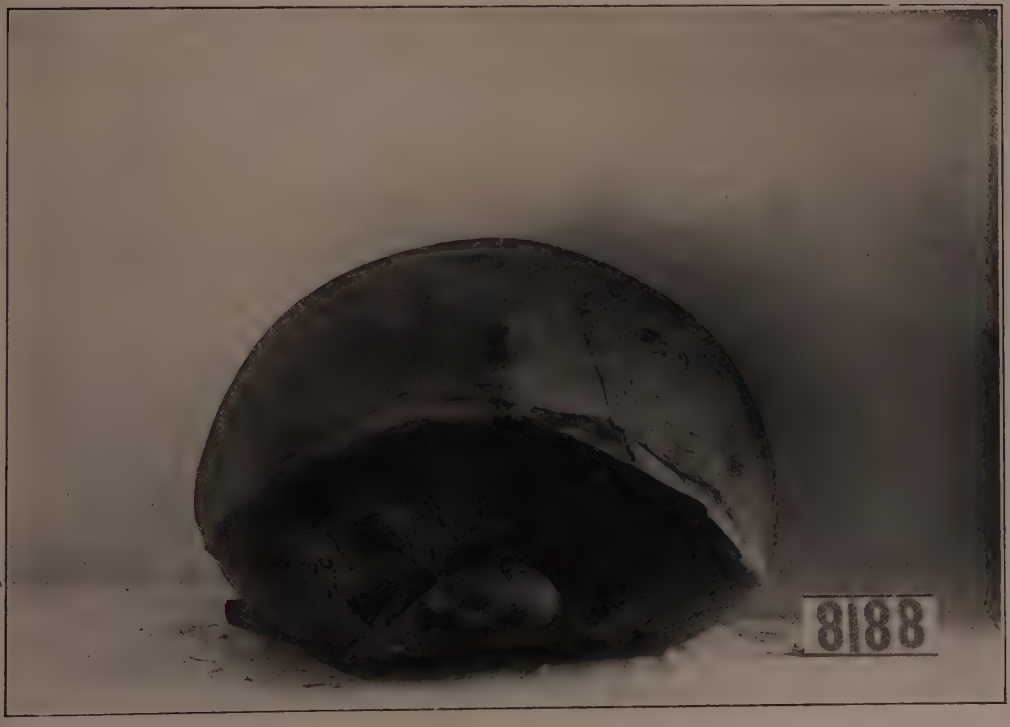


Fig. 2. Testudo vicina Günther.
Vilamil, Albemarle Island. 33 inch male. From in front.

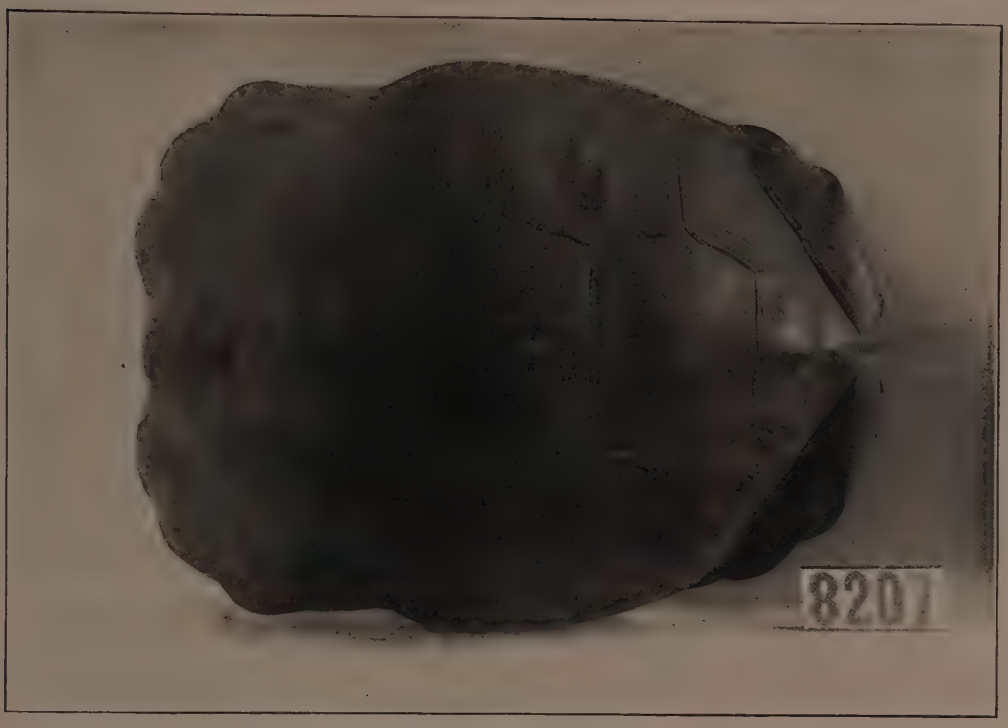


Fig. 1. Testudo vicina Günther.
Vilamil, Albemarle Island. 26.8 inch male. From above.

Fig. 2. Testudo vicina Günther.
Vilamil, Albemarle Island. 26.8 inch male. From side.

Fig. 1. Testudo vicina Günther.
Vilamil, Albemarle Island. 26.8 inch male. From in front.

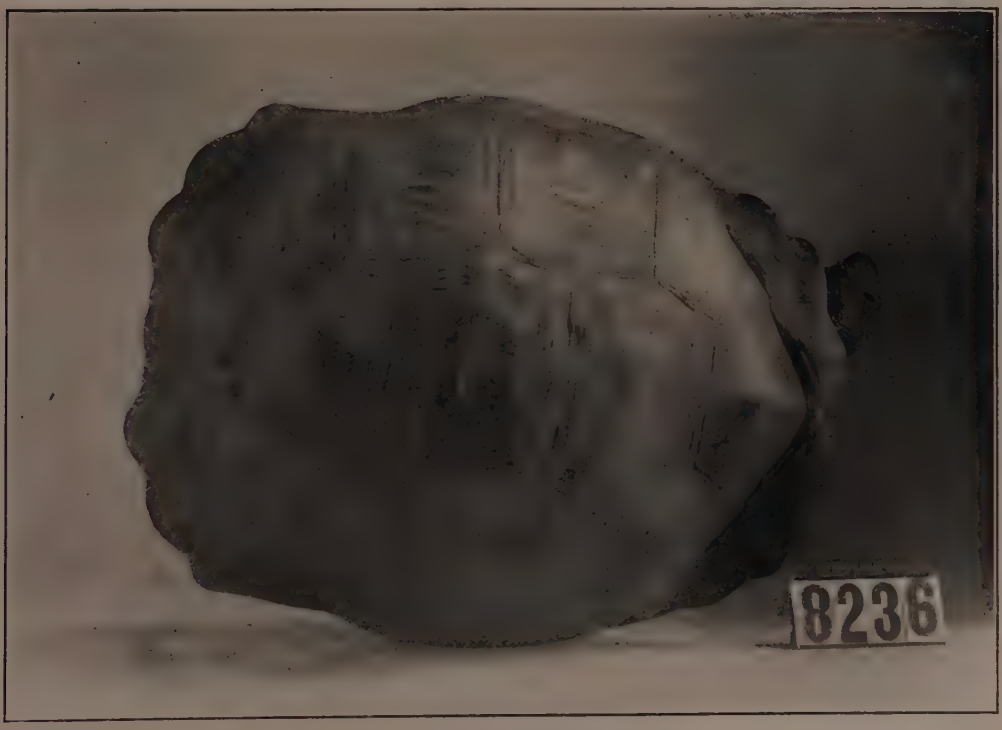


Fig. 2. Testudo vicina Günther.
Vilamil, Albemarle Island. 24.4 inch male. From above.

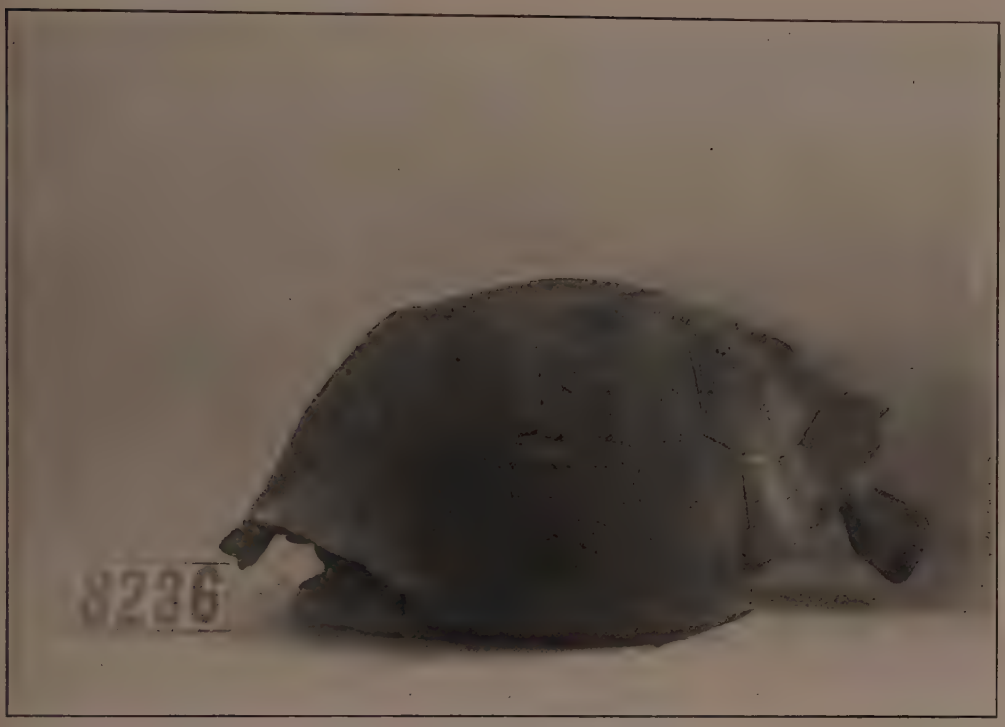


Fig. 1. Testudo vicina Günther.
Vilamil, Albemarle Island. 24.4 inch male. From side.

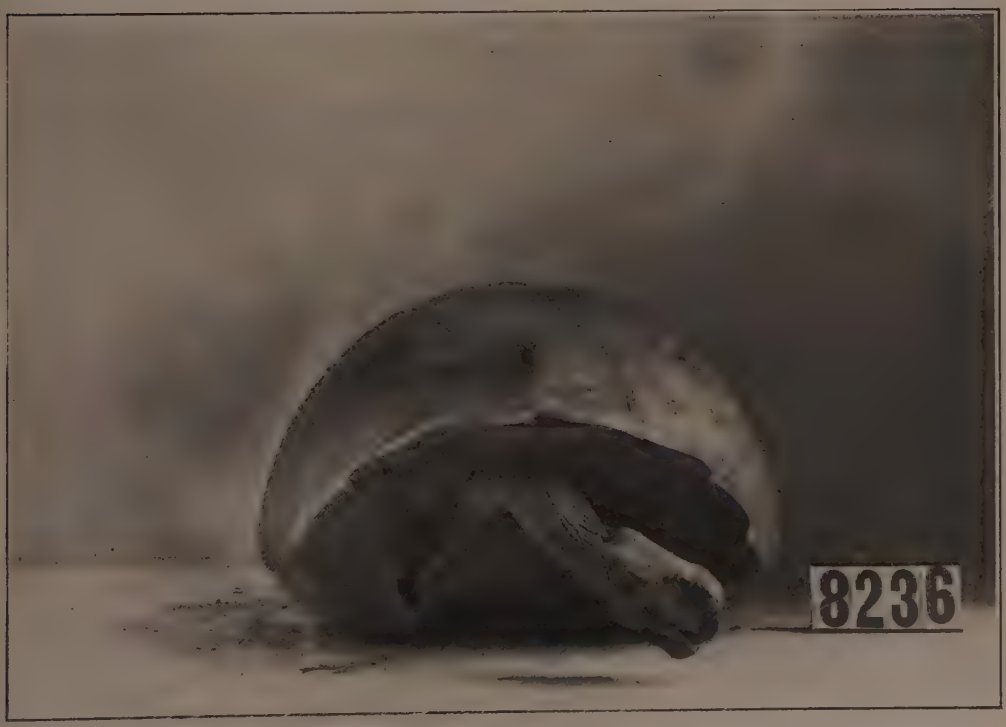


Fig. 2. Testudo vicina Günther.
Vilamil, Albemarle Island. 24.4 inch male. From in front.

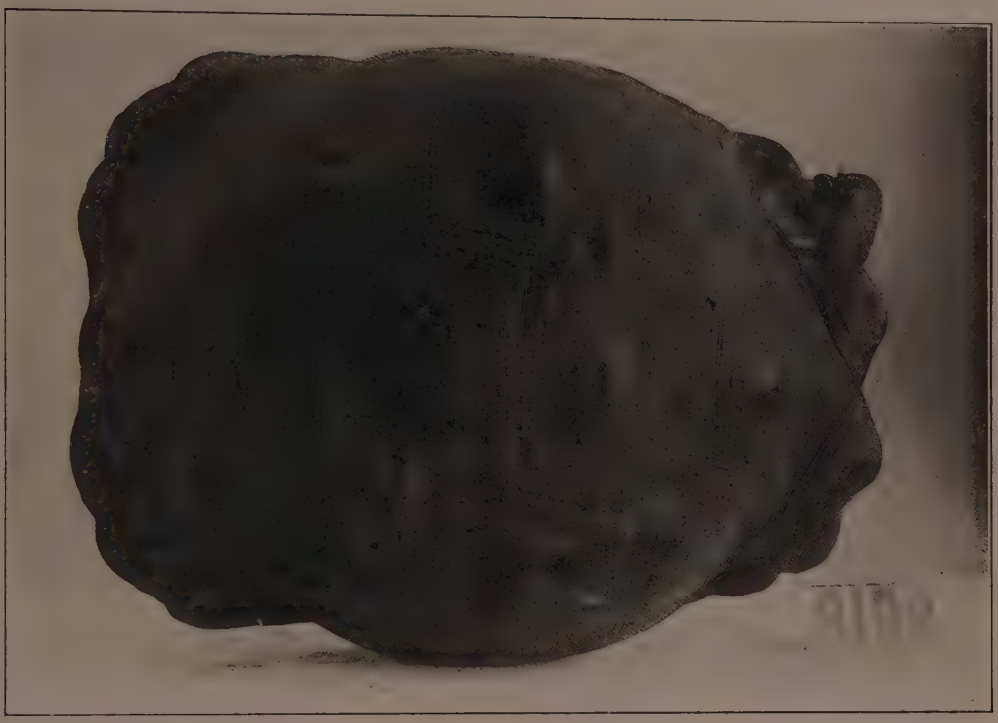

Fig. 1. Testudo vicina Günther.
Vilamil, Albemarle Island. 28.75 inch female. From above.

Fig. 2. Testudo vicina Günther.
Vilamil, Albemarle Island. 28.75 inch female. From side.

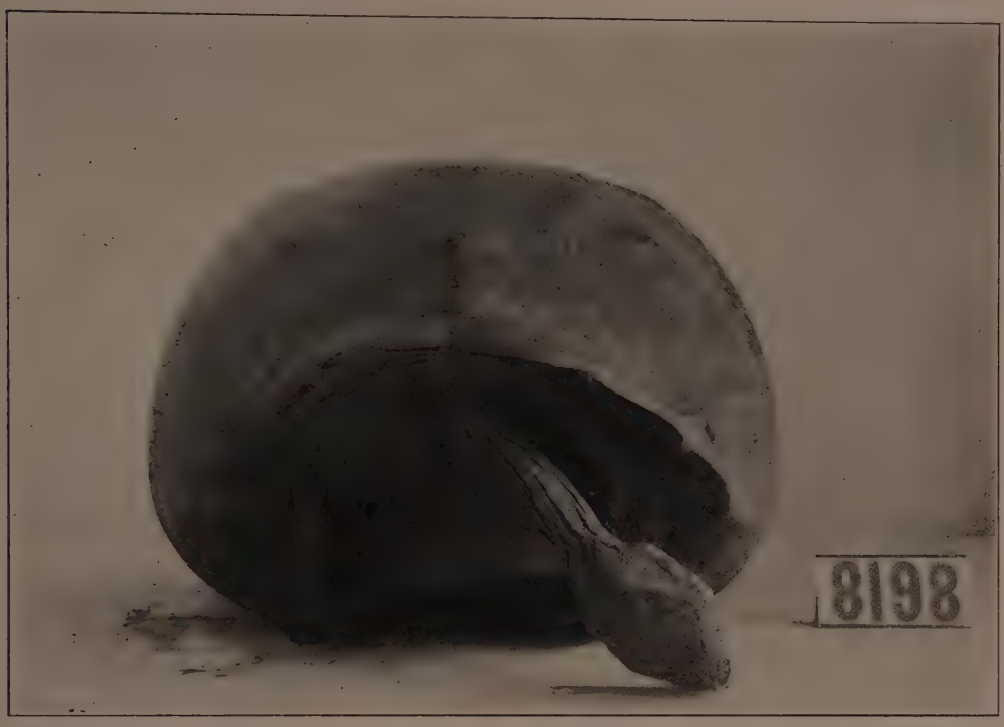


Fig. 1. Testudo vicina Günther.
Vilamil, Albemarle Island. 28.75 inch female. From in front.

Fig. 2. Testudo vicina Günther.
Vilamil, Albemarle Island. 27.5 inch female. From above.

Fig. 1. Testudo vicina Günther.
Vilamil, Albemarle Island. 27.5 inch female. From side.

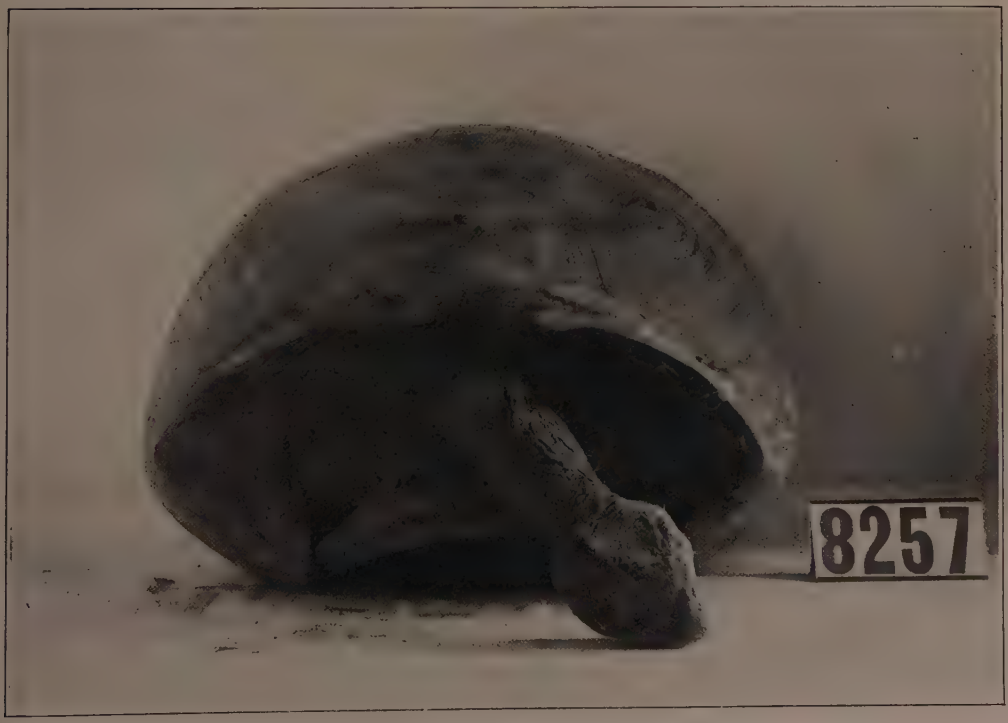


Fig. 2. Testudo vicina Günther.
Vilamil, Albemarle Island. 27.5 inch female. From in front.

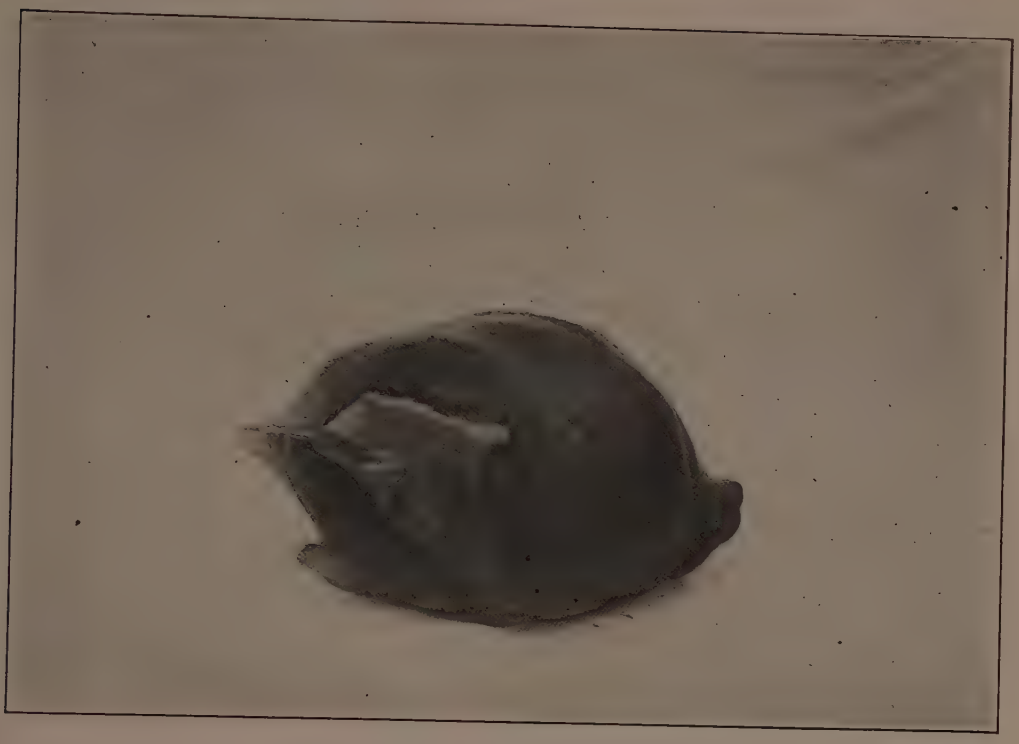

Fig. 1. Testudo wallacei Rothschild.
Type specimen in the Tring Museum.

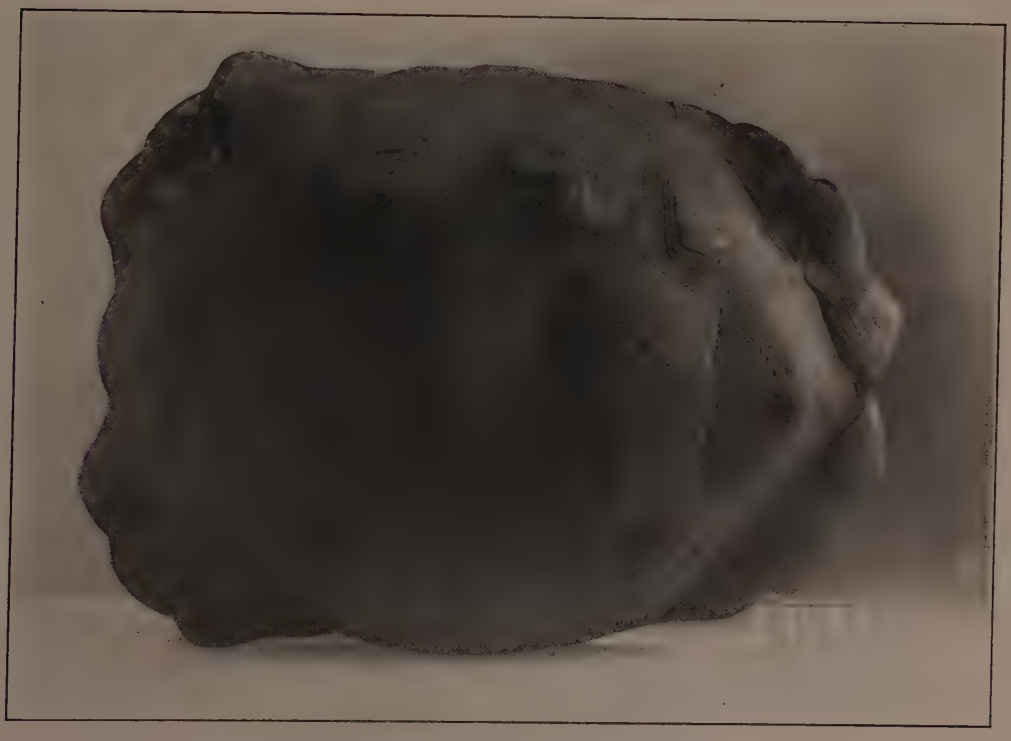

Fig. 2. Testudo wallacei Rothschild.
Jervis Island. 36.2 inch male. From above.

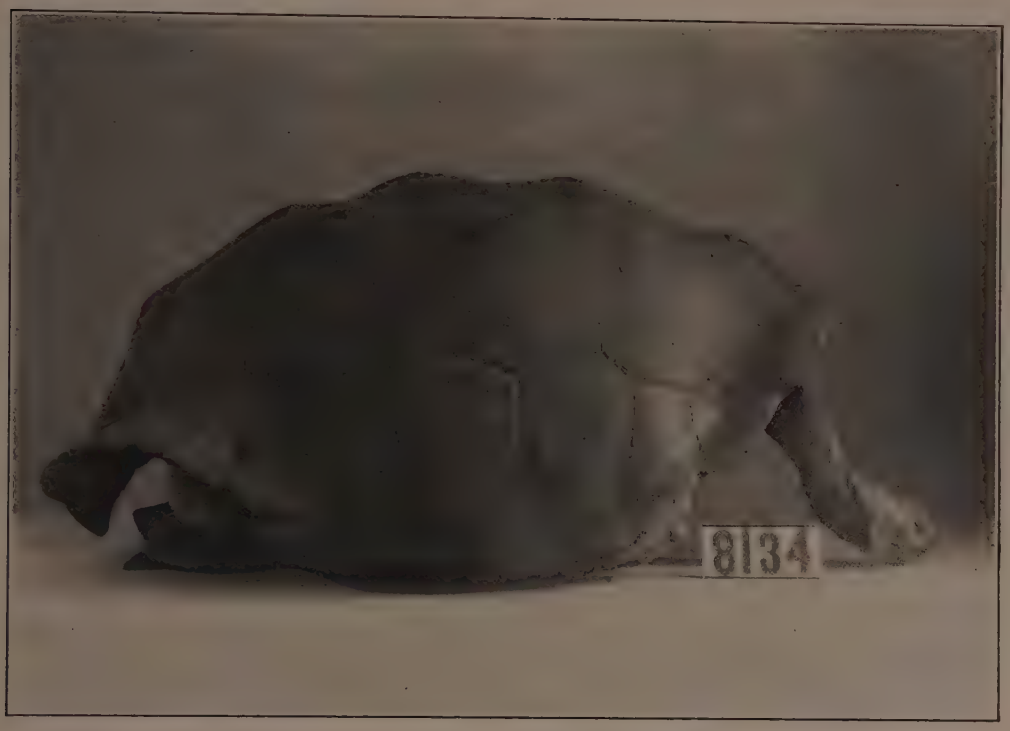


Fig. 1. Testudo wallacei Rothschild.
Jervis Island. 36.2 inch male. From side.

Fig. 2. Testudo wallacei Rothschild.
Jervis Island. 36.2 inch male. From in front.

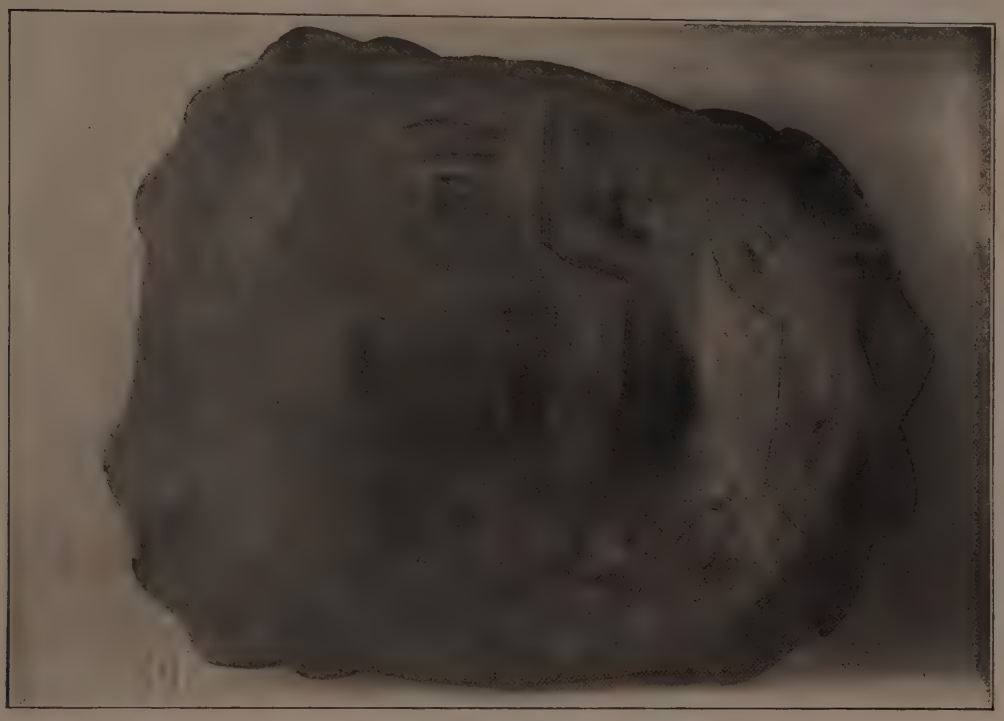

Fig. 1. Testudo porteri Rothschild.
Indefatigable Island. 41.4 inch male. From above.

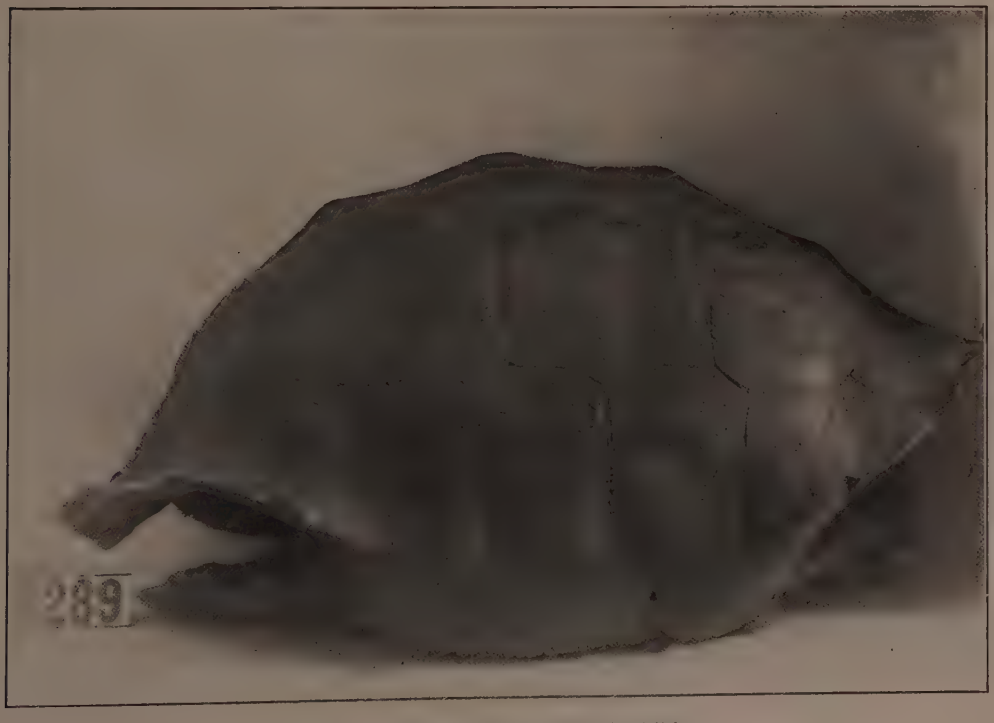


Fig. 2. Testudo porteri Rothschild.
Indefatigable Island. 41.4 inch male. From side.

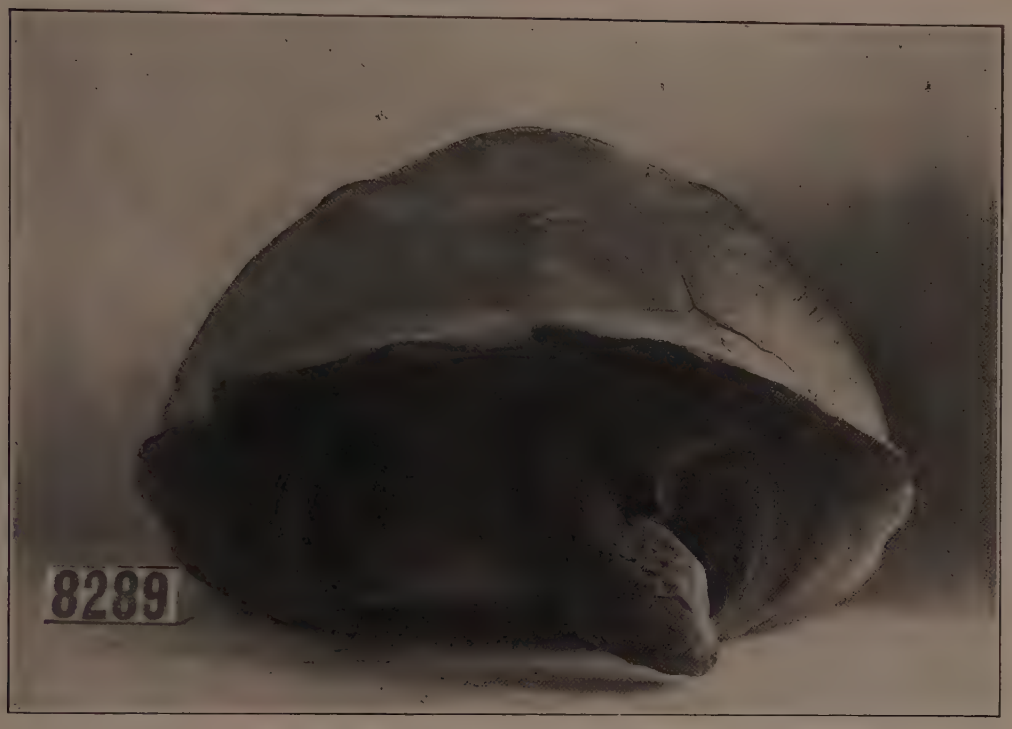


Fig. 1. Testudo porteri Rothschild.
Indefatigable Island. 41.4 inch male. From in front.

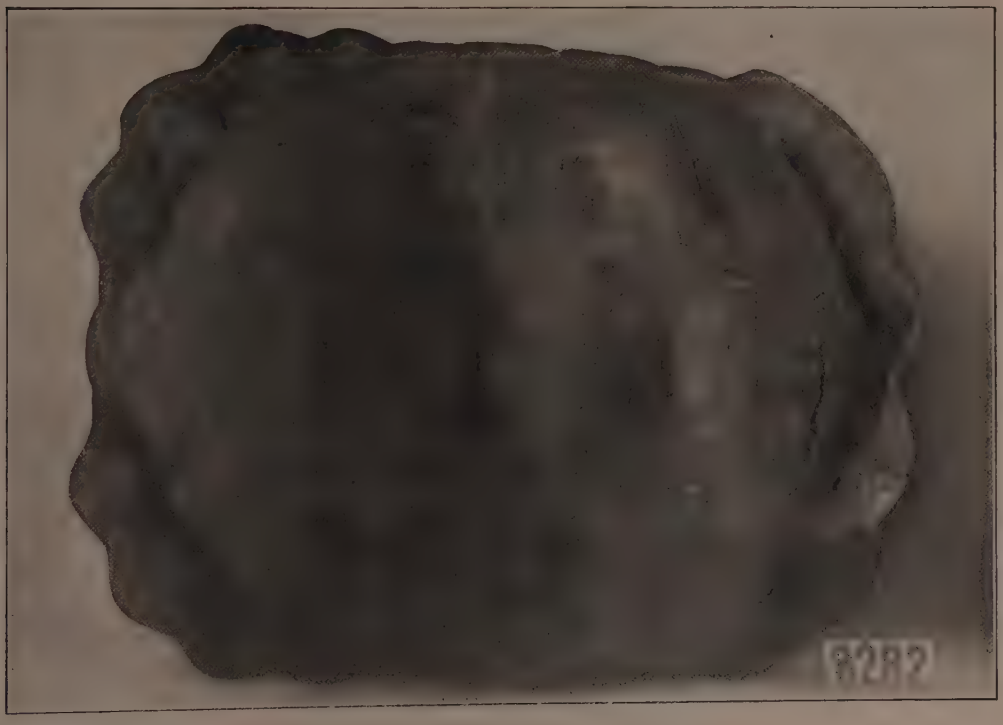

Fig. 2. Testudo porteri Rothschild.
Indefatigable Island. 40 3 inch male. From above.

Fig. 1. Testudo porteri Rothschild.
Indefatigable Island. 40.3 inch male. From side.

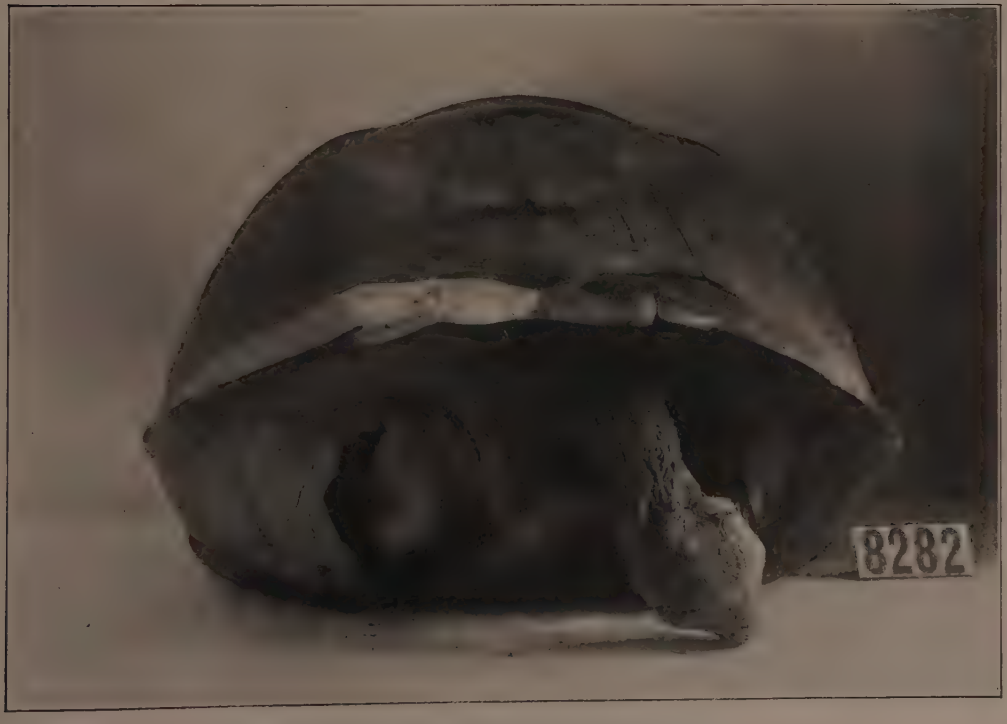


Fig. 2 Testudo porteri Rothschild.
Indefatigable Island. 40.3 inch male. From in front.

Fig. 1. Testudo porteri Rothschild.
Indefatigable Island. 39.6 inch male. From above.

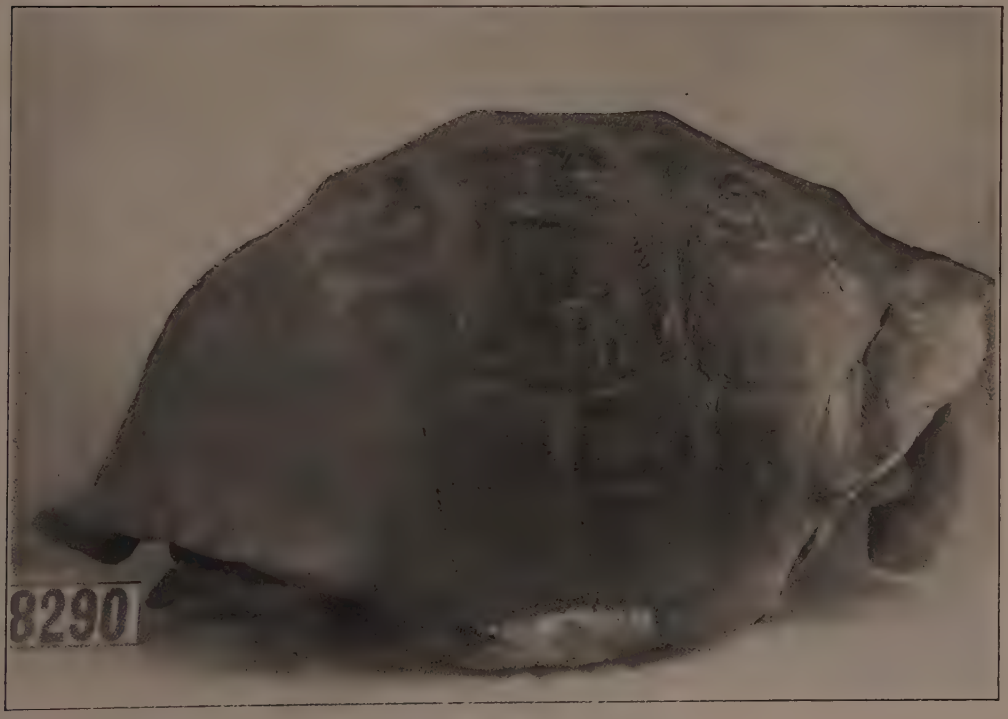


Fig. 2. Testudo porteri Rothschild.
Indefatigable Island. 39.6 inch male. From side.

Fig. 1. Testudo porteri Rothschild.
Indefatigable Island. 39.6 inch male. From in front.

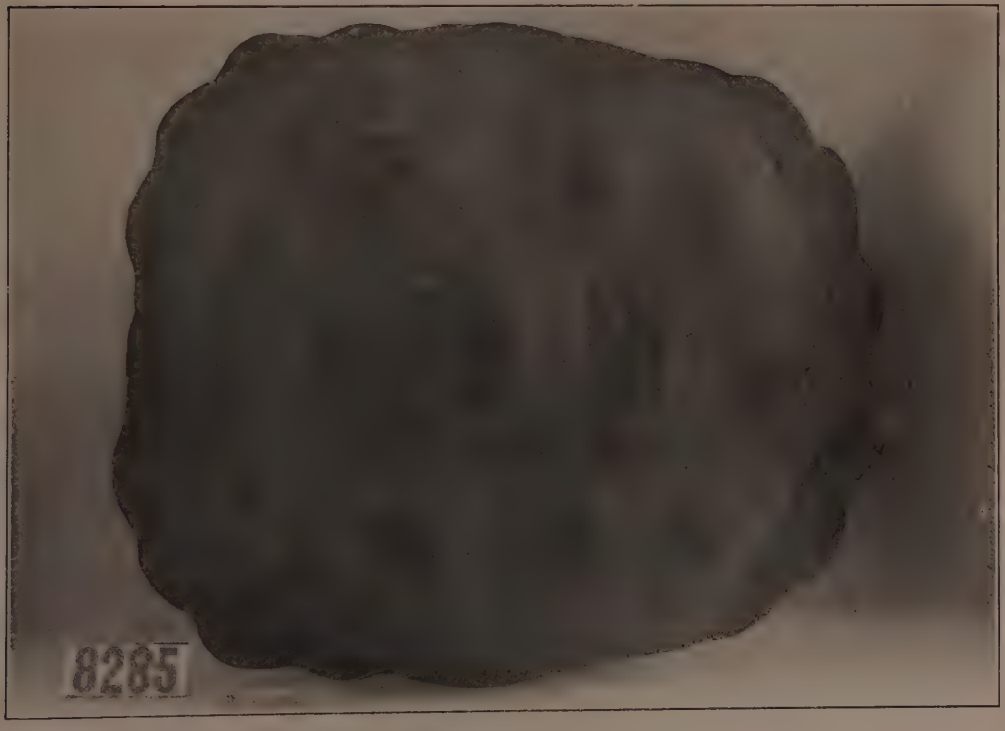


Fig. 2. Testudo porteri Rothschild.
Indefatigable Island. 35.5 inch male. From above.

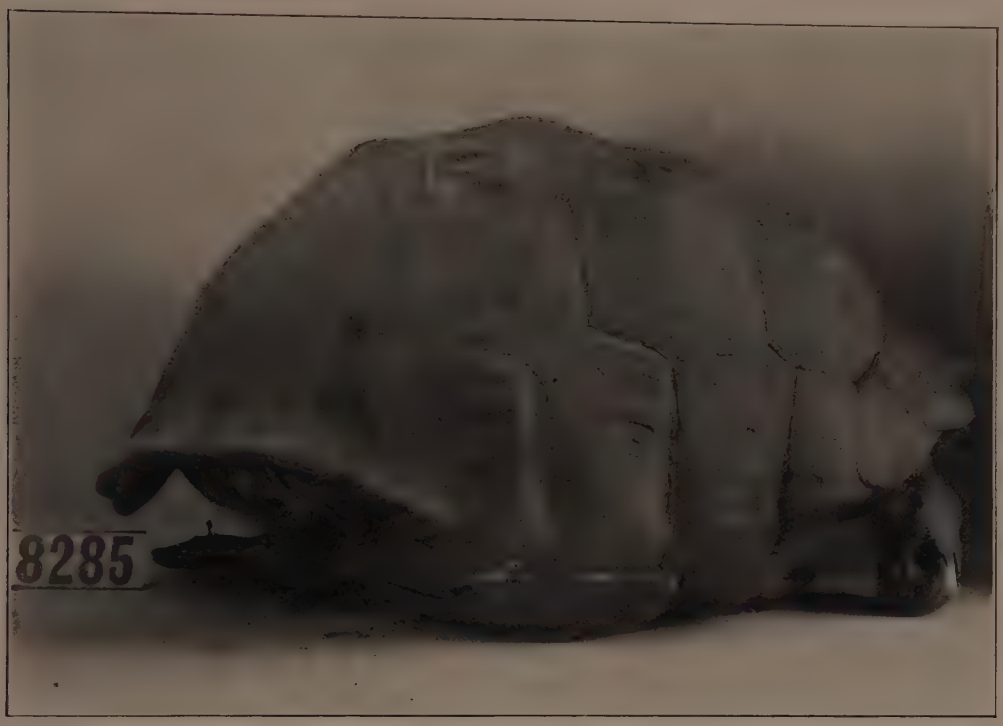


Fig. 1. Testudo porteri Rothschild.
Indefatigable Island. 35.5 inch male. From side.

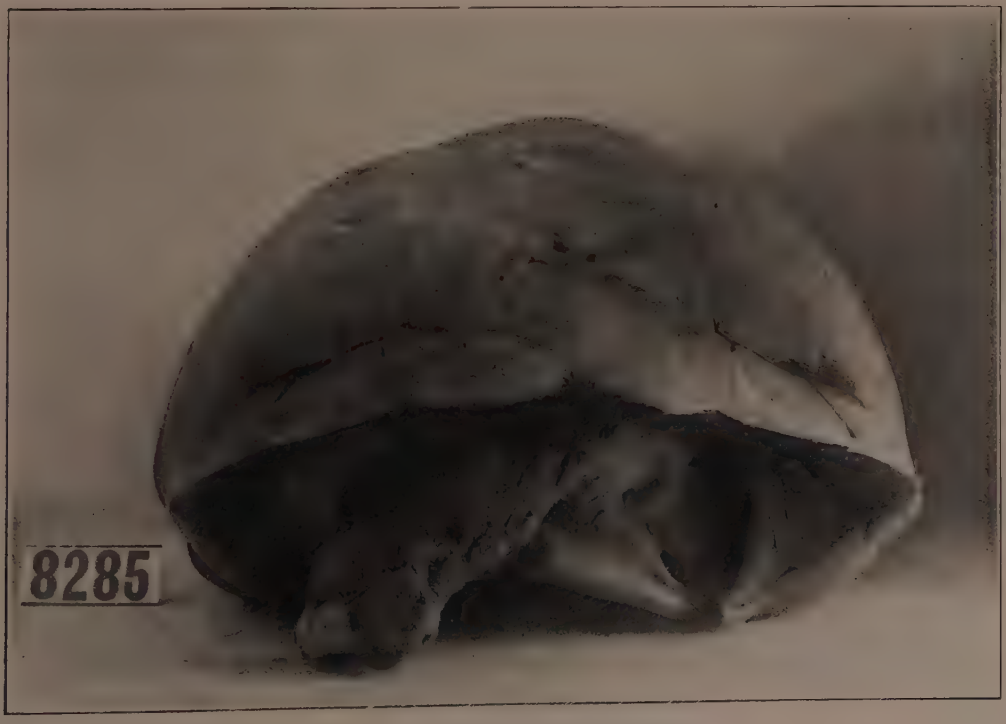


Fig. 2. Testudo porteri Rothschild.
Indefatigable Island. 35.5 inch male. From in front.

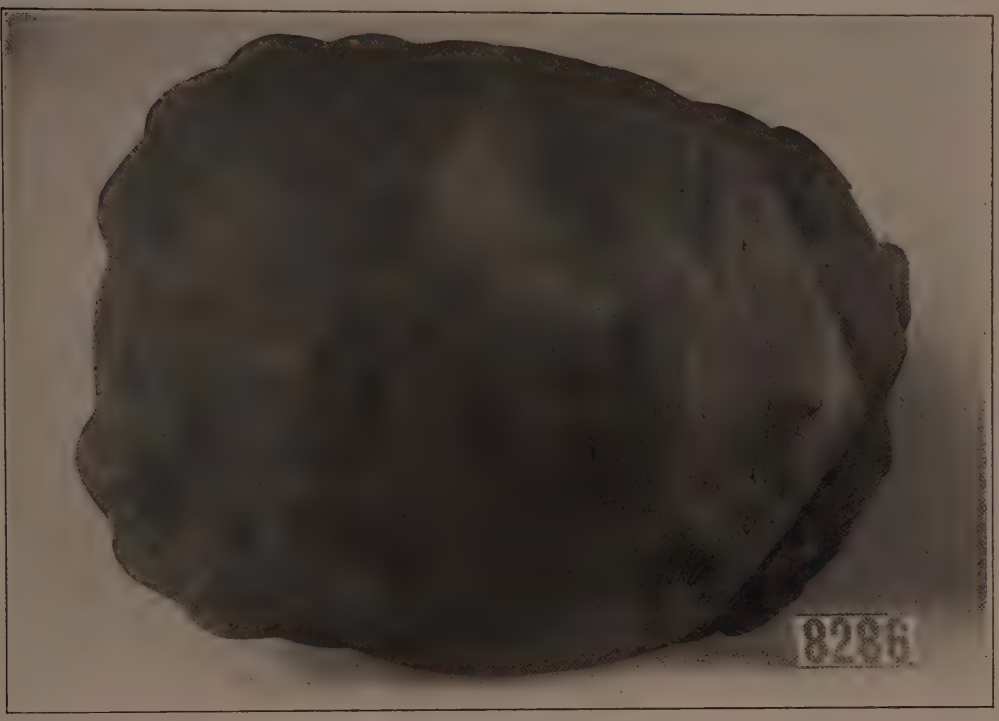


Fig. 1. Testudo porteri Rothschild.
Indefatigable Island. 35.8 inch female. From above.

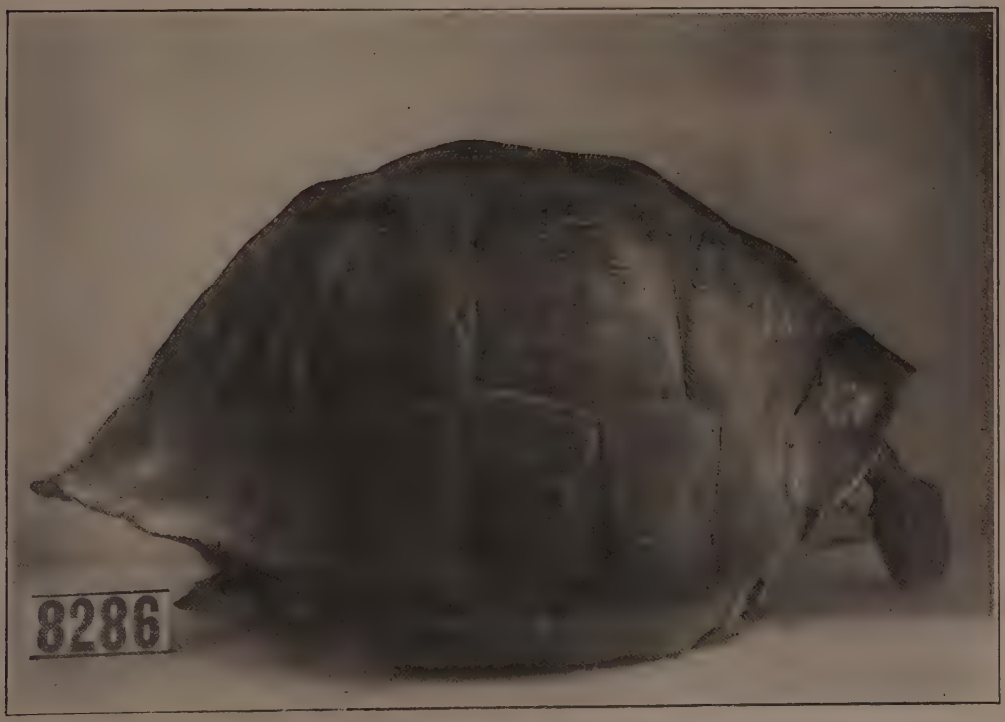


Fig. 2. Testudo porteri Rothschild.
Indefatigable Island. 35.8 inch female. From side.

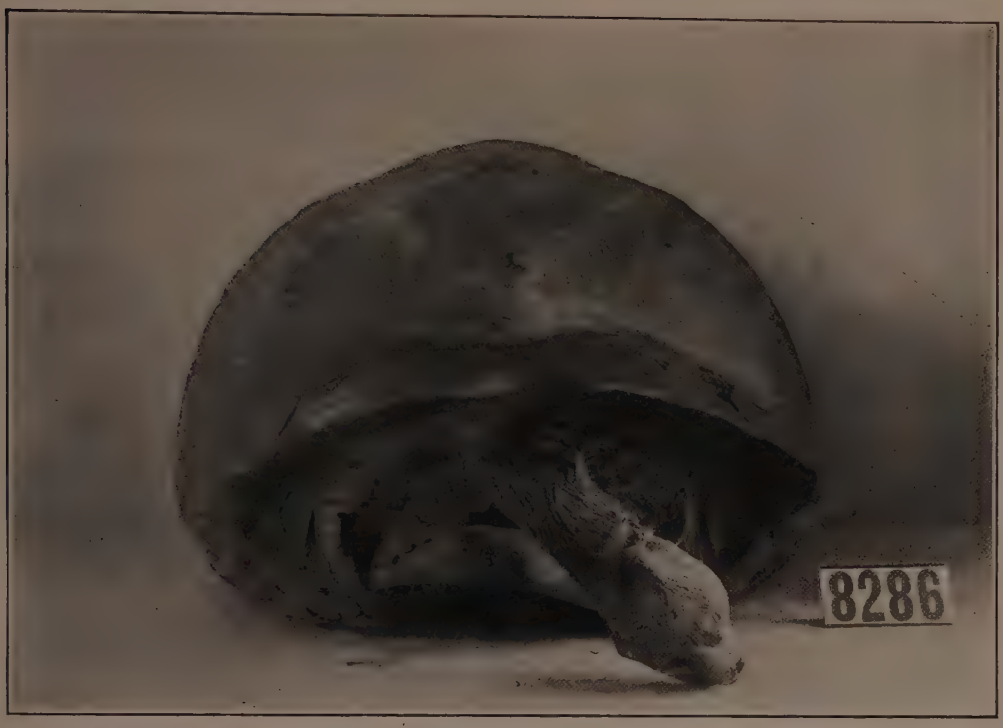


Fig. 1. Testudo porteri Rothschild.
Indefatigable Island. 35.8 inch female. From in front.

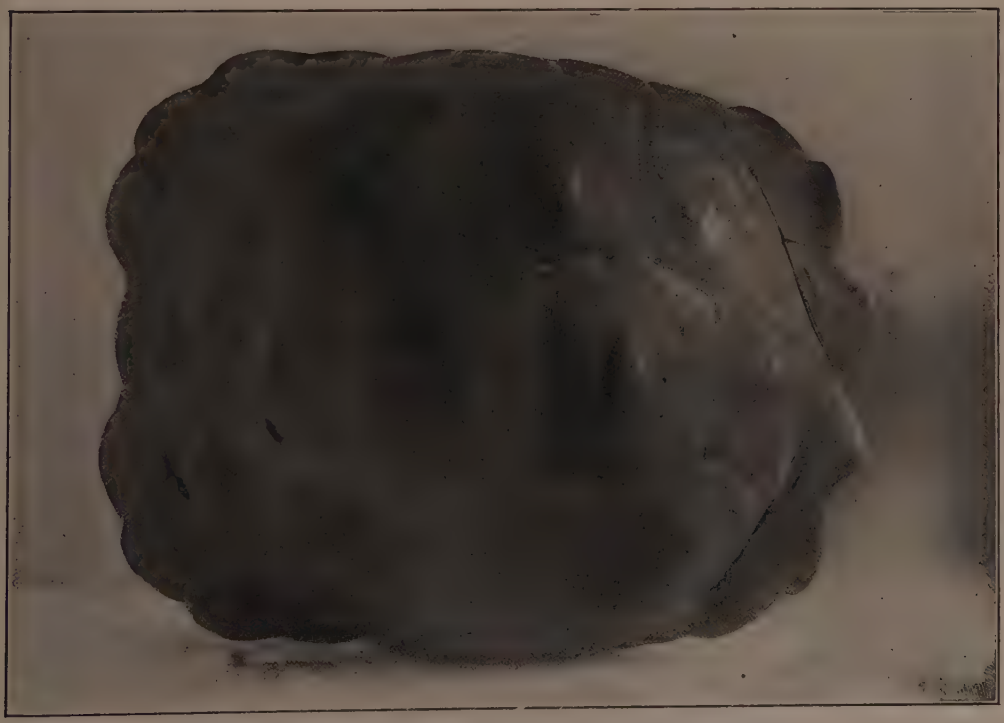

Fig. 2. Testudo porteri Rothschild.
Indefatigable Island. 28.75 inch female. From above.

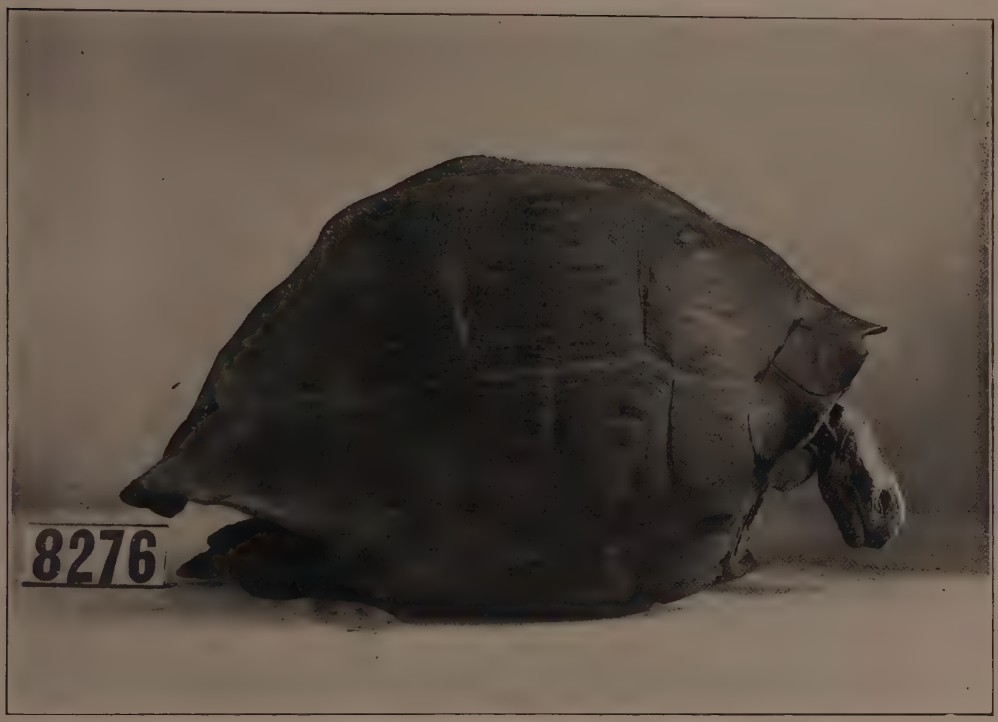


Fig. 1. Testudo porteri Rothschild.
Indefatigable Island. 28.75 inch female. From side.

Fig. 2. Testudo porteri Rothschild.
Indefatigable Island. 28.75 inch female. From in front.

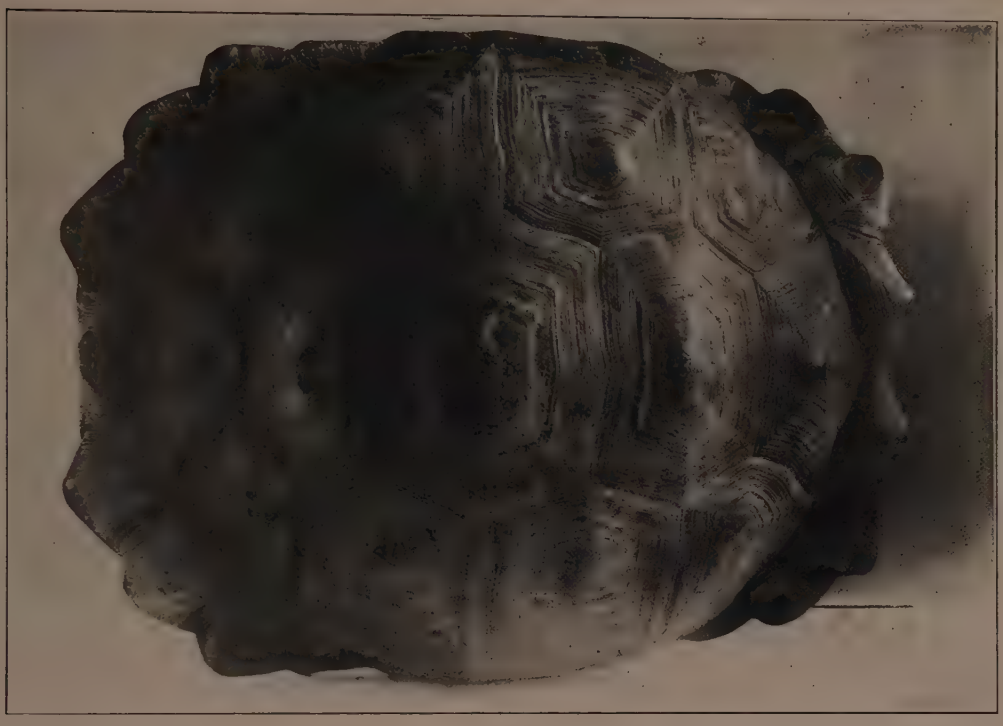

Fig. 1. Testudo, species.
Cowley Mountain, Albemarle Island. 26.75 inch female. From above.

Fig. 2. Testudo, species.
Cowley Mountain. Albemarle Island. 26.75 inch female. From side.

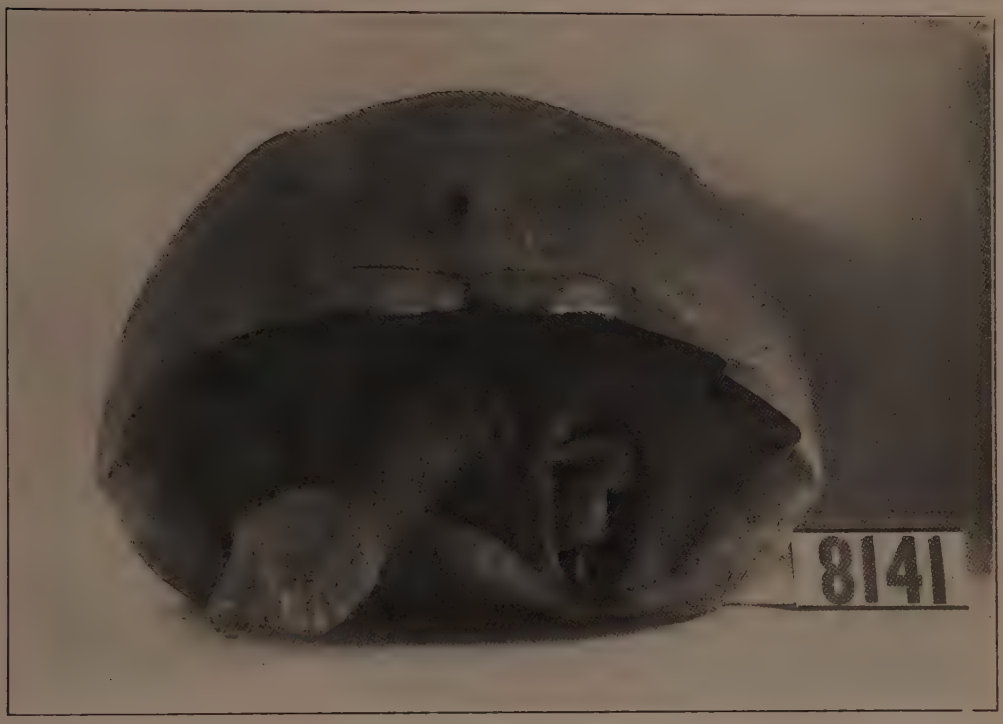


Fig. 1. Testudo, species.
Cowley Mountain, Albemarle Island. 26.75 inch female. From in front.

Fig. 2. Testudo, species.
Barrington Island. Bones of tortoises.

Eggs of Galapagos Tortoises. From left to right these eggs are from

Vilamil, Albemarle Island. Barrington Island. Duncan Island. Indefatigable Island.

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# EXPEDITION OF THE CALIFORNIA ACADEMY OF SCIENCES TO THE GALAPAGOS ISLANDS, 1905-1906

XI

# Preliminary Descriptions of New Species of Pulmonata of the Galapagos Islands

BY

WILLIAM HEALEY DALL

SAN FRANCISCO

PUBLISHED BY THE ACADEMY

1917

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## XI

## PRELIMINARY DESCRIPTIONS OF NEW SPECIES OF PULMONATA OF THE GALAPAGOS ISLANDS

BY WILLIAM HEALEY DALL

A full discussion of, and report upon, the collection of landshells and Tertiary fossils collected by Mr. W. H. Ochsner has been prepared and submitted for publication. But the publication seeming likely to be delayed, it was thought best to print diagnoses of the new species in order that the credit due to the collector and to the Academy might not be diminished by later researches carried on by other agencies.

The types of these new forms form part of the Academy's collection; cotypes have been deposited in the collection of the U. S. National Museum at Washington.

It is expected that when the complete report is issued the species will be suitably figured, and that report contains a full discussion of their relations to other previously described species and to the conditions under which they live.

The descriptions of the new species of fossils are less likely to be anticipated and are therefore left for appearance in the final report.

1. **Bulimulus (Næsiotus) elæodes,** new species

Shell small, ovate-conic, with six whorls separated by a well marked suture, the nucleus strongly striated, the apex dimpled, thin, fragile, with low feeble wrinkles, sometimes strong on the base; color oily white, with irregular brownish axial streaks, and a concentration of reddish brown in a narrow space in front of the suture and on the pillar; aperture less than half as long as the shell, body without enamel, outer lip very thin and sharp, pillar thin, short, straight with a slight reflexion over a narrowly perforate umbilicus. Length of shell 13.5 ; of last whorl 6.5 ; diameter 7.0 mm.

Albemarle Island, on leaves, hibernating, at 1500 to 2300 feet elevation, near Banks Bay; Ochsner.

2. **Bulimulus (Næsiotus) hemærodes,** new species

Shell small, livid pinkish brown, of five and a half whorls; the apex dimpled, the nuclear whorls distinctly transversely minutely ribbed; surface of spire polished, with microscopic spiral striation not beaded; the transverse sculpture varying in individuals from faint incremental lines to regular narrow riblets or irregular ridges; on the last whorl especially the most extremely rugose sculpture has a worm-eaten appearance, while in other individuals the rugosities may be minute and regular, or deferred to the last quarter of a whorl. Normal specimens show a pale, narrow peripheral band, but in very rugose individuals this is lost; the last whorl, especially when very rough, is whiter than the rest of the shell; margin of the aperture thin, sharp, the outer lip not reflected, the umbilicus a narrow perforation; the axis continuously tubular, simple, not twisted. Length of shell 12 ; of last whorl 9 ; diameter 7 mm.

Hibernating under dead wood on Cowley Mountain, Albemarle Island, between 2100 and 2300 feet elevation, in the grassy zone; and hibernating on the grassy rim of the crater of Narborough up to 4500 feet; Ochsner.

3. **Bulimulus (Næsiotus) perrus,** new species

Shell small, shiny, ruddy brown, a narrow pale area in front of the suture; apex blunt, dimpled nucleus faintly

transversely striated; whorls rounded with a deep suture; sculpture of rather irregular feeble axial wrinkles, stronger on the last whorl; base rounded, with a minute umbilical perforation; aperture with a thin sharp, not reflected margin; pillar short, reflected over the umbilical perforation; there are a few obscure spirals on the upper whorls, but no distinct or regular spiral striation. Length of shell 12.0 ; of last whorl 8.0 ; of aperture 5.5 ; diameter 6.0 mm.

Narborough Island, in the grassy area at the rim of the crater, 2000 to 4500 feet elevation; Ochsner.

### 4. **Bulimulus (Næsiotus) cucullinus,** new species

Shell with a dimpled apex of livid slate-color, two strongly transversely striated nuclear whorls and about four subsequent moderately convex whorls separated by a distinct but not deep suture; color of the shell grayish white, covered by an olivaceous brown periostracum, smooth but not lustrous; sculpture only of inconspicuous incremental axial lines, more or less irregularly disposed; base produced, with a very narrow umbilical perforation largely covered by the reflected inner lip; aperture subovate, the margin callous, expanded and almost reflected; the pillar and outer lips united across the body by a thin layer of vitreous enamel, the rest of the margin of the aperture conspicuously white, the throat livid. Length of shell 19 ; of last whorl 12 ; of aperture 9 ; diameter 9.5 mm.

Found by Mr. Ochsner on Hood Island hibernating under stones between 200 and 600 feet elevation; a variety with faint indications of a peripheral band, with the others and also on Charles Island in the moist area under moss and grass at 1650 feet; and on Barrington Island under stones in hibernation at 200 feet; lastly a paler variety on Hood Island at 380 feet elevation.

### 5. **Bulimulus (Næsiotus) albemarlensis,** new species

Shell of the general aspect of *tortuganus* but larger; solid, stout, inflated, short-spired, with six rapidly increasing whorls; apex dimpled, nuclear whorls small, transversely

striated; sculpture of upper whorls of retractively inclined close-set rather vermiculate axial wrinkles crossed by numerous fine sharp spiral striæ; in some specimens this sculpture covers the whole shell but in most the last whorl becomes rudely and irregularly coarsely wrinkled and punctate to a greater or less extent; the normal sculpture retains the pinkish light brown color which follows the rose pink of the apical turns, but when the abnormal wrinkling begins the surface becomes of a dirty white color; a pale peripheral band on the last whorl is preserved in most specimens; the suture is deep but not channelled; the base rounded, with an almost imperforate umbilical pit partly covered in the adult by the reflexion of the pillar lip; aperture subquadrate, the margin thickened but the outer lip not reflected, showing a slight thickening in fully adult specimens on its inner side medially; the pillar has a thick lump of white callus upon it, and is joined to the outer lip over the body by a deposit of enamel; the throat is of a dark flesh-color. Length of shell 15 ; of last whorl 12 ; of aperture 8 ; diameter 9 mm.

On bushes and grass near Villamil at 2300 to 3300 feet elevation; Ochsner.

6. **Bulimulus (Næsiotus) akamatus,** new species

Shell solid, chocolate brown, of six and a half whorls; apex dimpled, dark crimson, nuclear whorls transversely striated; sculpture of rather irregular moderately prominent incremental lines, except on the last half of the last whorl which is irregularly malleated and indented the whole crossed by very faint and minute spiral striæ; suture distinct, not deep, base rounded with a rather wide subcylindric umbilical perforation; aperture small with a continuous, thickened, not reflected margin; callosities white, that on the pillar continued halfway through the last whorl, diminishing around the axis; the medial thickening of the outer lip is also continued backward some distance, as is a very prominent narrow tubercle on the body between the two lips; the upper part of the axis is slender and simple. Length of shell 15 ; of last whorl 10 ; of aperture 5.5 ; diameter 8 mm.

Found by Ochsner on Indefatigable Island, under blocks of lava, at 200 to 650 feet elevation, in the arid zone.

7. **Bulimulus (Næsiotus) adelphus,** new species

Shell of the same general type as the preceding from which it is best distinguished by a differential diagnosis; it is of a light or very pale yellowish brown with a paler peripheral band, six whorls, retractively, closely, axially threaded, the threads cut into granules by sharp spiral striæ, the last half of the last whorl irregularly corrugated; the axial perforation larger, the aperture subquadrate with continuous margin thickened but not reflected, a large tubercle on the pillar, a prominent one medially on the inside of the outer lip, a much smaller one on the body deeper in the throat; the axis is simple, tubular and not twisted. Length of shell 14.5 ; of last whorl 10.0 ; of aperture 5.5 ; diameter 9 mm.

Found with the preceding species by Ochsner in the arid zone.

8. **Bulimulus (Næsiotus) lycodus,** new species

Shell small, solid, subacute, white, or yellowish white, with a rose pink or bluish apex and six rapidly enlarging whorls; upper whorls finely, retractively, axially, closely threaded, with fine spiral striation, the suture appressed; last whorl very coarsely, irregularly corrugated and punctate; base rounded with a narrow umbilical perforation; aperture with a thick continuous white margin slightly expanded but not reflected; the mesial thickening of the outer lip obsolete, perceptible in only a few specimens; pillar with a very anterior strong anteriorly inclined tubercle, continued into the throat as a diminishing ridge around the axis of the last whorl; on the body is a sharp prominent narrow tooth also prolonged backward as a narrow ridge; axis in the upper whorls very slender and conspicuously twisted. Length of shell 11 ; of last whorl 8 ; of aperture 4.5 ; diameter 8 mm.

Found by Ochsner on Indefatigable Island on tree trunks at 450 to 550 feet elevation.

9. **Bulimulus (Næsiotus) alethorhytidus,** new species

Shell small, resembling the preceding but with the prominent characters exaggerated and the size much reduced; whorls five, rapidly enlarging, nucleus sparsely transversely minutely lamellose, dimpled, the first three whorls rather

irregularly retractively axially finely wrinkled; last two coarsely irregularly strongly wrinkled all over; umbilicus minutely perforate, base rounded; aperture small, contracted, thickened, with continuous not reflected margin; pillar and body with prominent tubercles, that on the pillar continued backward into the penultimate whorl as an obscure plait, that on the body also continued for a shorter distance in the last whorl, the axis in the earlier whorls slender, perforate. Length of shell 8.0 ; of last whorl 5.5 ; of aperture 3.5 ; diameter 5.5 mm.

Indefatigable Island, in the moist area on the south side at 350 to 400 feet, and at all altitudes in the interior; Ochsner.

10. **Bulimulus (Næsiotus) cymatias**, new species

Shell small, solid, uniform yellowish brown, with nearly seven whorls, rapidly enlarging; surface uniformly sculptured with slightly irregular retractive narrow, close-set wrinkles crossed by extremely fine spiral threads of which at regular intervals one is more prominent than the rest; near the aperture are some irregular rugosities or indentations in some specimens but no change of color; there is a narrow inconspicuous pale peripheral band ending behind the median tubercle of the outer lip; base rounded, umbilicus narrowly perforate; aperture with a continuous thickened margin, a well defined tubercle inside the outer lip, a strong tooth anteriorly on the pillar, and one on the body; both these are continued into the shell, the one on the pillar as a strongly undulated ridge which extends, diminishing into the penultimate whorl, while the parietal tooth also extends inward about half a whorl, but less distinctly undulated and rapidly diminishing; the tubercle on the outer lip is hardly extended. Length of shell 14 ; of last whorl 8 ; of aperture 5 ; diameter 8 mm.

Indefatigable Island, under lava blocks in a moist area between 400 and 650 feet elevation; Ochsner.

11. **Bulimulus (Næsiotus) ochsneri**, new species

Shell chocolate brown, with no indications of a peripheral band, solid, stout, with six and a half whorls; apex dimpled, closely transversely sculptured, tinged with deep carmine;

sculpture of the upper whorls much like that in *B. cymatias* but the spiral sculpture more or less broken into dots; last half of the last whorl with the surface irregularly coarsely corrugated, but with no change of color; suture distinct, not appressed; aperture with a thickened white, not reflected, continuous margin; umbilical perforation small; outer lip straight, not reinforced in the middle by any ridge or tubercle; pillar with a large shapeless tubercle on the middle which is not produced backward into the whorl; body with a small tubercle moderately produced inward in a feeble way; axis of the upper whorls, simple tubular. Length of shell 17.5 ; of last whorl 13.0 ; of aperture 8.0 ; diameter 10.0 mm.

Indefatigable Island, under lava blocks at 200 to 650 feet altitude; Ochsner.

12. **Bulimulus (Næsiotus) jervisensis,** new species

Shell rude, showing remnants of a brown periostracum, short-conic, with five and a half whorls; nucleus crimson, dimpled, transversely irregularly feebly wrinkled; the last one irregularly more or less corrugated; spiral sculpture of fine sharp close-set striæ over the whole shell; aperture slightly thickened at the margin, not reflected, the pillar and outer lips united by a layer of enamel on the body; umbilical perforation very small; an obscure small tubercle on the body, and in most specimens a slight ill-defined thickening on the pillar; axis slightly twisted, very slender in the upper whorls. Length of shell 17 ; of last whorl 13.5 ; of aperture 9 ; diameter 11 mm.

A few dead specimens were collected on Jervis Island at an elevation of 900 to 1000 feet, by Mr. Ochsner.

13. **Bulimulus (Næsiotus) rabidensis,** new species

Shell rather elongate, its profile more cylindrical than in *sculpturatus,* thin, of about seven slightly convex whorls, separated by a distinct, not appressed, suture; apex dimpled, nucleus transversely minutely ribbed; the next two or three whorls sharply closely spirally threaded, the threads slightly pustular when they cross axial irregularities; the subsequent whorls irregularly subaxially rugose with low broken ridges, increasing in number and strength toward the aperture; the

spirals continue to the aperture; the color of the last whorl dirty white, the earlier whorls dull flesh color, the apex usually pale, and in rare instances a pale peripheral band is present; umbilical perforation minute; aperture with a thickened not reflected, continuous margin, the pillar and body as well as the outer lip without projecting callosities; the axis very slender and distinctly twisted, probably not tubular. Length of shell 15.5 ; of last whorl 9.0 ; of aperture 5.5 ; diameter 7.0 mm.

Obtained by Mr. Ochsner in "a fairly dry" region on Jervis (or Rabida) Island, at an altitude of 900 to 1000 feet.

### 14. **Helicina (Idesa) ochsneri,** new species

Shell much resembling *H. nesiotica* in a general way but higher, more conical and slightly larger; while *nesiotica* has a thin smooth periostracum and the specimens are clean when living, the present species has a blackish periostracum which is raised on the spire between the sutures into two or three fringed short spiral threads. The periostracum appears to be of an adhesive nature and all the specimens in their original condition are more or less covered with a blackish coating. When this is cleaned off the underlying shell has much the coloration and surface of *nesiotica.* Maximum diameter of shell 4.7 ; height 3.5 mm.

Albemarle Island, eight miles west of Turtle Cove, near salt lagoon; and at Cowley Mountain on moist ground, 350 to 500 feet above the sea; Ochsner.

### 15. **Williamia galapagana Dall.**

Shell small, ovate, conical, the apex curved forward and situated at about the anterior third of the length; surface probably with a thin periostracum when fresh, but in all specimens seen this has been lost and the surface is brilliantly polished; the color is of a rosy brown with numerous paler radial streaks; margin simple, often slightly irregular from adapting itself to the sustaining surface; muscular scar interrupted as usual in the family. Length 9.0 ; height 3.5 ; breadth 7.0 mm.

Station on floating seaweed at the Galapagos Islands; specimens collected on the beach at Hood and Chatham Islands.

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